TDR6

Modular Integrated Reciever Decoder for High Definition and Standard Definition TV

Installation and Operation Guide

TIERNAN

A Radyne ComStream Company

Notice

Contents

Preface

Using This Guide   This guide describes the installation, operation, and configuration of the Tiernan TDR6 Modular Integrated Receiver Decoder (TDR6). An overview of system and product level requirements, technical specifications, and troubleshooting procedures are also provided.

This guide is designed to help you find information quickly and easily. To take full advantage of this design, please take a moment to review the specific formats.

Locating Information

To help you quickly locate information, this guide includes:

- Table of contents
- Index
- Glossary
- Quick reference cards

Important Information

Throughout this guide you will find icons designed to help you identify important information. These icons are:

DANGER!
Electric Shock
Hazard

The hazard icon identifies the possibility of electric shock when you perform an operation with the TDR6 or if you do not use the TDR6 according to instructions.

CAUTION!
Please Read
Carefully

The caution icon identifies information that requires careful attention in order to prevent equipment damage and/or injury to the operator.

NOTE

The note icon identifies information for the proper operation of your equipment, including helpful hints, shortcuts, or important reminders.

Illustrations

Some illustrations contained in this guide may differ slightly from those shown on your front panel display, rear panel, or remote terminal due to variations in your system setup, configuration, or customization.

Figures depicting equipment may differ from those at your site; therefore, refer to the labeling on your Tiernan equipment to identify the components. An effort has been made to use illustrations that reflect basic equipment and configurations of the majority of customers.

Issuing Commands

Tasks and examples are presented in a series of step-by-step instructions. Commands or information that you enter into the system appear in a different type, as shown in the following example:

To restore the factory default1 configuration, select `config>default>restore>default1` from the front panel, or issue the remote command `mc default restore default1`.

If the command contains variable information that is to be typed into the system, the variable information is found within karats < >. In the following example, you would type the command `mc default restore` then the correct value for `<string>`: Type `mc default restore <string>`

Front Panel Navigation

This guide uses right angle brackets (>) to indicate a sequence of menus, submenus, and menu items.

For example, select `Control>Clock>Date>June 03, 2003` means:

- From the control menu, select clock.
- From the clock menu, select date.
- At the date option, enter the date, June 03, 2003, in the correct format.

Displays

The system may return values and messages on a front panel LCD, remote terminal, or both. In this guide these values and messages appear in a different type: `date = 06/23/2003`

Revision History

This guide is periodically updated and revised. For documentation updates, call Tiernan Customer Service.

Revision	Date	Type of Revision
A	01/2002	Initial release. Corresponds to code version 2.53.
B	01/2003	Updated manual to include information and front panel and remote commands that support implementation of VBI 4:2:2 expanded windows and BISS features. Updated and added front panel and remote commands relating to auto select functionality (service, audio, and user data), video chroma, audio data and sample rates, BER, and signal levels. Removed the video Secam command. This manual corresponds to code version 3.20.

Customer Service

We hope this guide provides all the information and instructions you need to operate the TDR6. However, if you need assistance, contact Tiernan Customer Service at our corporate headquarters, located in the United States, through any of the following methods:

- Phone   858.657.5454, Monday – Friday,
          7:30 a.m. – 6:00 p.m. pacific standard time
- Fax   858.657.5455
- Email   support@tiernan.com
- After-hours *Emergency* Customer Service Paging: 858.657.5454, option 5 Leave a detailed voice message and your call will be returned.

Product Shipments

Please verify that your company name and address are correct on the packing slip that is included with your equipment. Notify Tiernan Customer Service if any of the information is incorrect.

Ensure that you write down the following numbers and include them in any correspondence with Tiernan concerning your order:

- Purchase order
- Model
- Reference line
- Sales order

Errors

If any part of your shipment is missing or incorrect, call Tiernan Customer Service.

Cartons and Packing Materials

The factory shipping carton and packing materials are designed to protect the equipment from excessive shock and vibration that can occur during shipping.

Use the original shipping carton and packing materials to repack the unit for shipment to another location or to return the unit to Tiernan for repair.

For additional information on equipment repacking, refer to the Warranty booklet that accompanied the product shipment.

LCD Display

When you receive your TDR6, the LCD display may be covered with a plastic protective covering. To remove the protective covering, gently lift one of the corners and peel off the covering.

Warranty Information

For warranty or return material authorization information, refer to the Warranty booklet that accompanied the product shipment.

Other Tiernan Products

The Tiernan Web site, found at www.tiernan.com, provides information about the entire line of Tiernan products and systems, including encoders, integrated receivers/decoders (IRD), switches, ATM products, network interfaces, and network management software.

Safety Precautions

Carefully read and follow all safety, use, and operating instructions before operating the TDR6. Heed all warnings and cautions contained in this guide. Retain these instructions for future reference.

Follow Startup Procedure

Do not plug in the TDR6 until you have connected the system and read the chapter on installation.

Provide a Safe Location

Place the TDR6 in a rack or on a stable surface of sufficient size and strength, where it will not be jarred, hit, or pushed off its surface. Ensure that all cables and cords are out of the way and will not be tripped over, as this could cause personal injury or serious damage to the equipment.

Avoid Water and Moisture

If the equipment is exposed to any liquid, contact Tiernan, as serious damage could occur to the TDR6 or its components.

Avoid Heat, Humidity, and Dust

To avoid internal damage, the TDR6 should be placed away from all heat sources, including radiators, heater ducts, and so on, out of direct sunlight and away from high humidity, excessive dust, or mechanical vibrations that can cause damage to internal parts.

Provide Adequate Ventilation

Slots and openings on the TDR6 are provided for ventilation that is needed to ensure reliable operation. To avoid overheating and ensure that the ventilation slots are not blocked, place the TDR6 on a smooth, hard surface that has at least two inches of clearance around the unit and adequate air circulation. If the equipment is placed in a closed area, such as a rack, ensure that proper ventilation is provided and that the internal rack operating temperature does not exceed the maximum rated temperature at the position of the unit.

Never place the TDR6 on a soft surface that would obstruct the required airflow into the ventilation slots.

Use Correct Power Source

For units equipped with a North American power cord, the cord has an IEC-compatible female plug on one end, and a male plug on the other end. This cord is UL and CSA approved up to 125 VAC at 10 A and is ready to use with no user wiring required.

For units equipped with an International power cord, the cord has an IEC-compatible female plug on one end, and three stripped and tinned bare wires on the other end. This cord is approved up to 250 VAC at 6 A and complies with the international color codes of green/yellow (ground), blue (neutral), and brown (line).

If these color codes do not correspond to the colored markings on the terminals in the plug, use the following standards:

- The green/yellow wire must be connected to the plug terminal marked by the letter E or by the earth symbol (⏚) or color-coded green and yellow.
- The blue wire must be connected to the plug terminal marked with the letter N or color-coded black.
- The brown wire must be connected to the plug terminal marked with the letter L or color-coded red.

An AC plug must be attached to the International power cord in accordance with government standards and codes in effect at the installation site. If an unterminated power cord is supplied with the unit, the appropriate certified termination plug must be installed. The following is a list of the required certifying agencies for various countries.

Country	Agency	Country	Agency
Australia	SAA	Italy	IMQ
Austria	OVE	Japan	MITI
Belgium	CEBEC	Netherlands	KEMA
Canada	CSA	New Zealand	SECV, SECQ, SECWA, EANSW, ETSA, HECT,
Denmark	DEMKO	Norway	NEMKO
Finland	FEI	Rep. S. Africa	SABS
France	UTE	Spain	AEE
Germany	VDE	Sweden	SEMKO
India	ISI	Switzerland	SEV
Ireland	IIRS	United Kingdom	ASTA, BSI

Route Power Cords Safely

Route power cords so they are not walked on or pinched. Pay particular attention to cords and connections at the plugs, receptacles (such as power strips), and the point where they exit from the TDR6 and attach to other equipment. Do not place any items on or against power cords.

No Stacking

Do not place or stack any objects on top of the TDR6. Other equipment may be placed in a rack or on a shelf above or below it, but never stacked directly on top of it.

Protect Against Lightning and Power Surges

When the TDR6 is installed, have the professional installer ground the system to protect against voltage surges and built-up static charges. For information on grounding standards for electrical and radio equipment, refer to the electrical code in the country of installation.

Protect the TDR6 from lightning and power-line surges during a storm by unplugging it from the wall outlet and disconnecting the coaxial cable.

Turn the TDR6 Off When Changing Circuit Boards

Turn the TDR6 off before installing or removing any circuit boards from chassis slots. Possible damage may occur to modem, boards, or related equipment if power is left on during this procedure.

Provide Antistatic Protection

Wear a properly grounded antistatic wrist strap to prevent electrostatic damage to components when handling circuit boards or other electronic modules.

Keep Objects Outside

Touching internal TDR6 parts is dangerous to both you and the unit. Never put any object, including your fingers, through slots or openings, as this could result in touching dangerous voltage points, short-circuiting parts, electric shock, or fire.

There are no user-serviceable parts inside the TDR6. If an object falls into the equipment, unplug the unit and contact Tiernan Customer Service, as serious damage could occur to the unit or its components.

Use Approved Attachments Only

Use only Tiernan-approved option cards and equipment with the TDR6.

Clean the TDR6

Before cleaning the TDR6, unplug it from the wall outlet. Do not use any type of abrasive pads, scouring powders, aerosol cleaners, or solvents such as alcohol or benzene.

Use only a clean, soft cloth lightly moistened with a mild detergent solution. Wipe all equipment with a clean, soft cloth lightly moistened with water to remove the detergent solution.

Service the TDR6

Do not attempt to service the TDR6 yourself, as there are no user-serviceable parts. Opening or removing covers may expose you to dangerous voltages or other hazards as well as void your warranty. Contact Tiernan Customer Service to obtain qualified service personnel.

The following conditions indicate that the equipment needs servicing:

- The power cord or plug has been damaged.
- An object has fallen into the TDR6.
- Liquid has been spilled into the TDR6, or it has been exposed to rain or water.
- The unit has been dropped or the cover has been damaged.
- The TDR6 does not operate normally, or it shows a marked change in performance.

Perform Safety Checks

Upon completion of any service or repairs to the TDR6, ask the service technician to perform safety checks to verify that the system is in safe operating condition.

Overview

1

The TDR6 is a high performance, modular receiver/decoder providing a high degree of flexibility to meet a variety of Standard Definition (SDTV) and High Definition (HDTV) applications.

It's modular design makes it easy to adapt to changing requirements in digital TV contribution and distribution networks.

Six module slots allow the flexibility of using common equipment for a variety of applications in SDTV requiring MPEG-2 4:2:2 Studio Profile @ Main Level or 4:2:0 Main Profile @ Main Level and HDTV requiring 4:2:0 Main Profile @ High Level video processing.

The TDR6 is designed to accept and process inputs from satellite to terrestrial sources.

Features The TDR6 contains a standard feature set that is extended by option modules. The standard feature set includes:

- Modular construction allowing the implementation of a variety of option modules
- Auto-sensing, auto-detecting of video and audio formats
- 4:2:2 and 4:2:0 digital video processing
- Auxiliary data delivery
- BISS Modes 0, 1, and E
- Front panel interface for local operation of the TDR6
- LED indicators including power, fault, and status
- Remote control via Ethernet or EIA-232 providing all configuration, monitor, and control functions
- Extensive self-diagnostics to assist with system checkout and problem solving
- Non-volatile, field-programmable memory
- User configuration sets that can store and recall commonly used parameters sets
- Auto-ranging, auto-sensing power supply
- Rugged chassis construction

Optional features include:

- Four L-band input QPSK, 8PSK, 16QAM demodulation with DVB-compliant FEC decoding, deinterleaving, and descrambling
- PAL, NTSC, and serial digital video output (SDTV)
- 1080i or720p video output (HDTV)
- Four additional AES/EBU digital stereo pairs of audio output
- ATSC audio pass-through mode (with external decoder)

The TDR6 supports both single-channel-per-carrier (SCPC) and multi-channel-per-carrier (MCPC) operations and can be deployed in either a point-to-point or point-to-multipoint system.

If the TDR6 has been configured to receive satellite transmissions, it will accept input from 950 to 2150 MHz at power levels between -65 dBm and -25 dBm. It can also interface directly with satellite low noise block (LNB) downconverter input at up to 30 Msps, -25 dBm to -65 dBm. The TDR6 will receive a DVB or ATSC-compliant input signal, demodulate and decode the signal, and deliver separate video, audio, and optional data (for example auxiliary data or teletext) signals.

If the TDR6 has been configured to receive a terrestrial transmission, it will accept a signal compliant with the acceptable formats described in the option module section, decode the signal, and deliver separate video, audio, and optional data signals.

Option Modules   The TDR6 has a modular construction which allows for easy expansion. The TDR6 accepts up to six option modules and can be rapidly altered to suit your needs.

Video Processing   The TDR6 can be configured to support SDTV in NTSC and PAL formats. Video output provides both analog composite and digital D1 MPEG-2 4:4:2 or 4:2:0 formats, which are automatically sensed by the decoder.

The TDR6 can also be configured to support decoding of HDTV signals in either 1080i or 720p formats through the use of an option module. HD Video output provides 1.5 Gbps SDI.

Audio Processing   The TDR6 provides decoding of up to two stereo or four mono channels of program audio in standard definition configuration.

A total of four additional stereo (or eight mono) channels of MPEG audio may be decoded using one additional option slot. Audio output is digital AES/EBU. Up to four AC3 audio channels are supported using external AC3 decoders.

Auxiliary Data Delivery   The TDR6 is able to decode and deliver uncompressed optional data streams. This data may take the form of non-specific auxiliary data, or, depending on the transmission site, may be data such as teletext or other video or audio specific data. The installed option modules define the data types the TDR6 can decode and deliver to the receive site.

In its basic configuration the TDR6 supports two channels of synchronous data up to 2048 kbps or asynchronous data up to 34.8 kbps on EIA-232 and EIA-422 ports.

Input Interfaces   The TDR6 can be configured for various inputs through the selection of input option modules. For example, a TDEM-6110 QPSK/8PSK/16QAM demodulator module allows the TDR6 to perform as an SDTV or HDTV IRD with four switchable L-band inputs.

Auto-Sensing Decoding   The TDR6 features auto-sensing of the audio and video formats. Once the unit is locked onto an incoming signal and a service is selected, the TDR6 automatically configures parameters based on the information detected in the selected service.

Monitor and Control Functions   The TDR6 monitor and control functions include:

- Front panel operator control utilizing an easy-to-use, intuitive menu and push-buttons
- Remote control using either an Ethernet or RS-232 interface

Front Panel   The TDR6 front panel interface allows you to scroll through a standard set of menus to easily set your operating parameters. All configuration and monitoring functions can be efficiently performed using the front panel.

The TDR6 menu structure will vary according to the option modules installed in your unit, however the standard menus exist in any TDR6 configuration.

At-a-glance system status can be quickly determined by checking the front panel power, fault and status LEDs.

Remote Control   A remote unit, such as a computer terminal, is easily connected to either the EIA-232 remote control port or Ethernet port allowing the TDR6 to be configured, monitored, and controlled using character-based ASCII protocol.

Programmable Memory   The TDR6 is a field deployable unit designed with a nonvolatile, field-programmable memory that ensures retention of configuration parameters in the event of power outages or during transportation.

Configuration Sets   The TDR6 has three default configurations and allows you to store up to four user-specified configuration sets.

Construction   The TDR6 is a 2RU (8.9 cm/3.5") high, 19-inch rack mount chassis with an international auto-sensing AC power supply.

Installing the TDR6

2

This chapter provides step-by-step procedures for installing and cabling the TDR6.

⚠ **DANGER!**
Electric Shock Hazard

Do not remove the TDR6 top cover! The TDR6 is powered by an exposed, switching AC power supply which presents an electric shock hazard when the top cover is removed. Personal injury or damage to the equipment can occur when the top cover is removed. None of the procedures in this manual require the removal of the TDR6 top cover.

⚠ **CAUTION!**
Please Read Carefully

Before beginning your installation, read the *Safety Precautions* as they contain important safety information and other instructions required to install the TDR6.

Placement

The TDR6 can be installed on a table top or in a rack. Use the following guidelines to determine the appropriate installation for your needs:

- If the equipment must be moved frequently, install the TDR6 on a table top or other flat surface.
- If the equipment is going to be installed permanently, install the TDR6 in a rack using rack mount brackets.

Whichever installation is used, always position the equipment to allow easy access to the rear panel and provide adequate ventilation.

To properly install the TDR6, follow the instructions provided in the appendix on table top and rack mount installation instructions.

Ventilation

The TDR6 must be positioned to receive adequate ventilation at all times. The cooling fan pulls air in through the side vents, circulates the air, and exhausts it out the side vents. The minimum air flow clearance required on both sides of the chassis is three (3) inches and six (6) inches for the rear panel.

Powering on the TDR6

The rear panel AC power supply interface includes an On/Off (—/0) power switch and an IEC 320 AC power cord receptacle. The maximum power supply output for the TDR6 is 200 watts. The typical TDR6 configuration requires 100 watts.

The TDR6 is powered by an auto-sensing, auto-ranging AC switching power supply. The power supply accepts 100 to 240 VAC at 50 to 60 Hz.

AC Power Cords

The TDR6 shipping kit includes two AC power cords, one for North American applications, specifically the United States and Canada, and the other for international applications.

⚠ **CAUTION!**
Please Read Carefully

AC wiring must be done in accordance with governmental standards and codes in effect at the TDR6 installation site. Refer to the *Safety Precautions* for additional information.

North American Applications

One cord has an IEC-compatible female plug on one end and a North American male plug on the other. This cord is UL and CSA approved up to 125 VAC at 10 A. This cord is ready to use with no user wiring required.

International Applications

The international cord has an IEC-compatible female plug on one end and three stripped and tinned bare wires on the other end. This cord is approved by many international safety agencies, including VDE, up to 250 VAC at 6 A.

Connecting to a Power Source

To connect to an AC power source, follow these steps:

1. Select an AC power cord. If an international power cord is selected, attach a connector in accordance with local regulations and laws.
2. Ensure the TDR6 power switch is in the Off, or 0, position.
3. Connect the female plug of the AC power cord to the AC power receptacle on the TDR6 rear panel.
4. Connect the male plug of the AC power cord to an external AC power conditioning surge suppressor.
5. Connect the AC power conditioning surge suppressor to an AC outlet.

⚠ **CAUTION!** Please Read Carefully

Corrupted AC input power can interrupt TDR6 operations and cause permanent damage to the unit. You should purchase and install a commercially available, external AC power conditioning surge suppressor to protect the TDR6 against power spikes and line transients.

Power-up Sequence

Once the cabling and interconnections for the TDR6 are completed, you may power-up the unit. The TDR6 power switch is a rocker switch located on the rear panel.

The power switch is labelled with a — and an 0. The — represents the On position, while the 0 represents the Off position.

To power up the TDR6, press the power switch to the ON, or —, position. The power-on cycle takes approximately three to four minutes to complete, as the unit performs extensive self-diagnostics in this time period.

During the powered-up cycle, the TDR6 displays Initializing, the Power LED illuminates green, and the Fault and Status LEDs may flash and illuminate. After the unit is initialized, the LCD displays the Decoder main menu.

```
DTV Receiver/Decoder
Config          Details        Faults      →
```

The TDR6 is initialized at the factory to the DVB-compliant configuration. You can change to another default configuration or set your own operating configuration.

Rear Panel Connections

The rear panel consists of option modules that have been selected and installed according to the needs of your organization. Available options modules include:

- TMAC-6125 — master controller module for both SD and HD applications
- TDEC-6161 — decoder module for HD applications
- TDEC-6100 — decoder module for SD applications
- TAUD-6100 — audio module providing 4 additional channels of audio
- TDEM-6110 — demodulator module for providing four L-band inputs

The location of the connection ports on the rear panel may vary depending on configuration of the option modules installed in your unit.
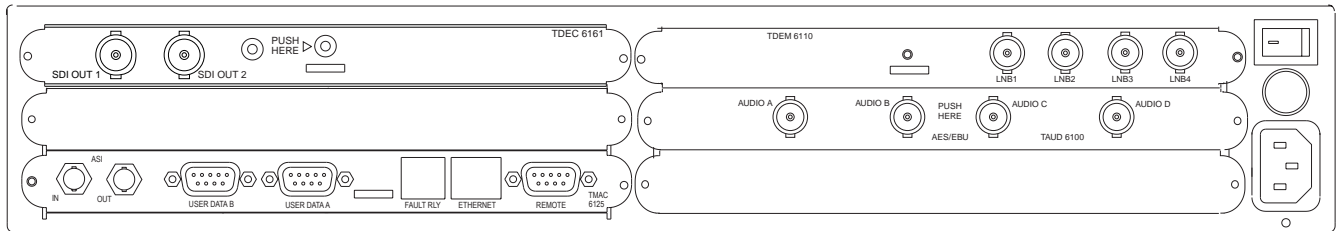
TDR6 HD Configuration with Optional Demodulator and Audio Modules Installed
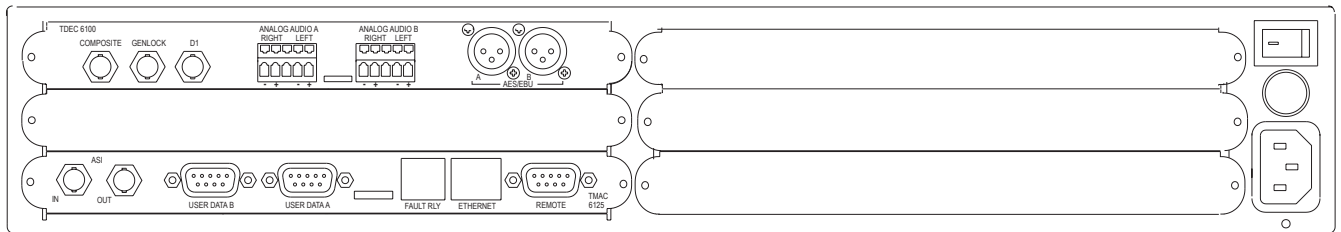
Basic TDR6 SD Configuration with No Option Modules Installed
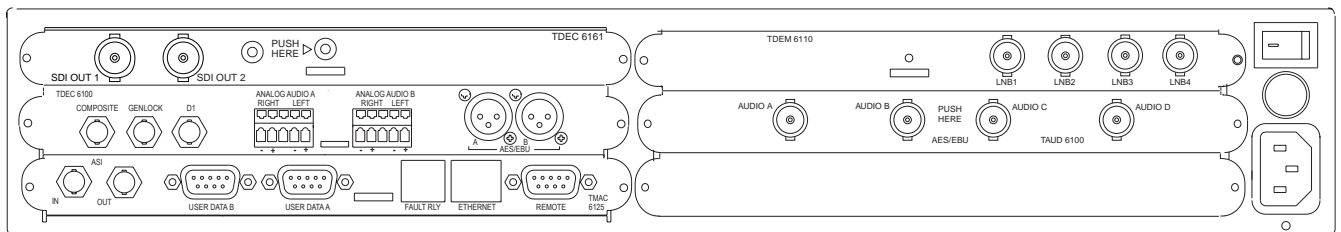
TDR6 Fully Configured for Both HD and SD Operations; All Option Modules are Installed

TMAC-6125   The TMAC-6125 is the master controller module.
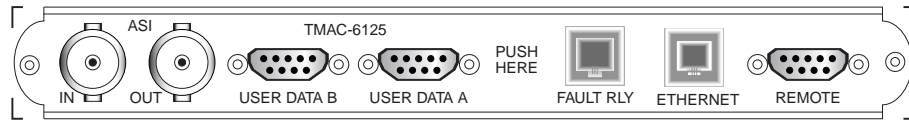
TMAC-6125 Ports

The TMAC-6125 provides the following ports:

- ASI IN – accepts the incoming ASI transport stream, with data rates up to 104 Mbps, on a female BNC connector, 75Ω impedance
- ASI OUT – outputs a DVB/ASI compliant transport stream as a loop through of the input signal on a female BNC connector, 75Ω impedance. The output follows the input selected, i.e., ASI or RF.

  The ASI Out port provides a pass through relay; if power is lost, the input is directly connected to the output.
- USER DATA A and B – identical data ports that are independently configurable for either RS-422 synchronous/asynchronous communications up to 4.096 Mbps or RS-232 asynchronous communications up to 38.4 kbps

  Both User Data ports are female, DB-9 connectors.
- FAULT RLY (relay) – female RJ-11 connector that provides three connections to create a form-C status relay

  The fault relay indicates a non-normal, or fault, condition when power is removed through a power failure, a power switch turned off, or an unplugged unit. The fault relay can also report user-programmable faults.

  A fault condition is indicated by contact closure between pins one and three, and an open contact between pins one and six. Fault Relay pin assignments are provided in the port pinout appendix.
- ETHERNET – female RJ-11 connector that provides remote control of the TRD6 over a network
- REMOTE – female DB-9 connector that provides an RS-232 remote control interface to the TRD6

  Remote control port pin assignments are provided in the port pinout appendix.

Connecting to a Remote Unit

The TMAC-6125 enables you to connect a remote unit to the TDR6 using the Remote port. A remote unit may be any device capable of asynchronous communications at RS-232 electrical levels including:

- Personal computer with an asynchronous communications software application installed
- ASCII computer terminal

To install a remote unit:

1. Connect a cable between the remote unit and the TDR6 remote control port.
2. Configure the communications software parameters of the remote unit to match the DVB default settings of the TDR6 remote control port.

3. Press the enter key on the remote unit several times until a prompt appears on the display of the remote unit. Typically the prompt is the > character.

   Once the prompt appears, successful communications have been established between the TDR6 and the remote unit.

   If communications cannot be established between the TDR6 and the remote unit, refer to the chapter on troubleshooting.

4. Reconfigure the remote control port settings as required for your site.

Connecting to a Network

You can connect the TDR6 to a LAN using the TMAC-6125 Ethernet port, which enables you to monitor and control the TDR6 through a remote unit not directly connected to the TDR6.

To connect a TDR6 to the Ethernet port:

NOTE When connecting the TDR6 to the Ethernet port, contact your Information System department to coordinate installation and setup.

1. Connect a Category 5 cable with RJ45 connectors (standard ethernet cable) between the TDR6 Ethernet port and a LAN hub.

2. Assign the device a unique IP address, if necessary.

   The TDR6 default IP address is 192.200.9.201. Contact your Information Systems department for a valid IP address.

   To change the IP address using the front panel:

   a. Select `Control>Network>IP Addr`.

   b. Using the keypad, enter the IP address in the format xxx:xxx:xxx:xxx where xxx is a decimal number between 0 and 999.

   c. Press the Enter button

   To change the IP address using a remote unit, enter the command `MC ETHERNET IP ADDRESS XXX.XXX.XXX.XXX` where XXX is a decimal number between 0 and 999.

3. Assign additional network information, if necessary.

   Depending on the configuration of the LAN, you may need to enter additional parameters including:

   ❏ Ethernet IP address mask (IP subnet mask)

   ❏ Ethernet IP gateway

   For additional information, refer to the MC commands in the chapter on using a remote unit.

4. From a personal computer connected to the LAN, try to ping the TDR6. At the command prompt of the personal computer, type
   `ping <TDR6 IP address>` where `<TDR6 IP address>` is the previously assigned address.

   If a reply is received, the TDR6 is correctly configured.

For information on establishing remote communications, refer to the chapter on using a remote unit.

TDEC-6161   The TDEC-6161 supports decoding of HDTV signals in either 1080i or 720p format. Video is output at 1.5 Gbps using the SDI interface.

The TDEC-6161 has two SDI ports, labeled SDI OUT 1 and SDI OUT 2.
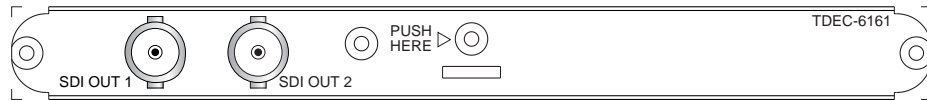
TDEC-6161 Ports

These two SDI ports provide identical serial digital bitstream outputs, using a 75Ω low-loss SDI cable. Both SDI OUT ports are BNC, 75Ω female connectors.

TDEC-6100   The TDEC-6100 SDTV video and audio decoder module processes MPEG-2 4:2:2 Profile @ Main Level and Main Profile @ Main Level. Video may be output as composite analog NTSC or PAL or serial digital.

The module processes audio MPEG-2 Layer I or Layer II. Audio may be output as analog or AES/EBU digital stereo.
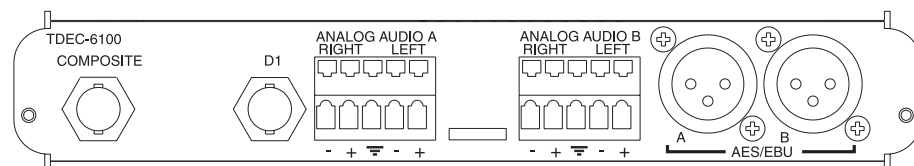
TDEC-6100 Ports

The TDEC-6100 ports are as follows:

- COMPOSITE—outputs composite analog video on a female BNC 75Ω connector
- D1—outputs digital video on a female BNC 75 Ω connector
- ANALOG AUDIO A and B—output balanced analog audio on terminal block 30 Ω connectors which are factory selectable to 600 Ω
- AES/EBU A and B—output balanced digital audio on male XLR 110 Ω connectors

Cabling the Analog Audio Connectors

The terminal block connectors consist of a row of detents on the top of the connector and a row of clamps on the bottom, as shown in the following graphic.
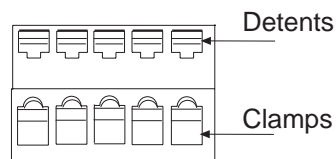
To cable the Analog Audio terminal block connectors:

1. Press the detent using a screw driver with a maximum width of .15 inch to open the clamp below it.
2. Insert audio cable wire into the clamp.
3. Release the detent. The clamp will close tightly on the inserted wire.

> **NOTE**
> Opening the clamp requires firm pressure. The required pressure may temporarily deflect the rear panel, but will not damage the unit.

TAUD-6100

The TAUD-6100 four-channel audio module process four MPEG-2 audio streams and provides AC3 audio passthrough.
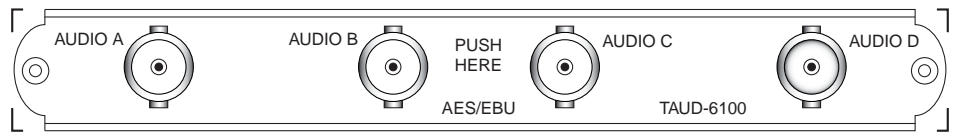
TAUD-6100 Ports

These four audio ports output unbalanced digital AES/EBU audio on female BNC 75 Ω connectors.

TDEM-6110

The TDEM-6110 QPSK demodulator module enables the TDR6 to perform as an SDTV or HDTV IRD with four L-band inputs.
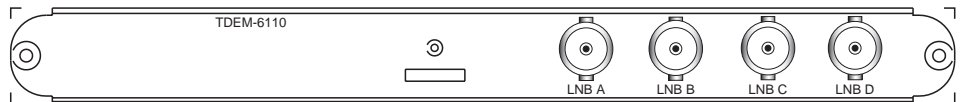
TDEM-6110 Ports

The LNB 1 through LNB 4 connectors are F-Type, 75 Ω female connectors that accept RF from 950 to 2150 MHz, at power levels between -65 dBm and -25 dBm.

Cabling the TDEM-6110

LNB ports A through D are used to connect the TDR6 to up to four satellite antenna LNBs. Although each of the four RF inputs can be independently configured, only one port may be active at a time.

The IFL cable loss should not exceed 25 dBm to ensure reliable IRD operation over a broad range of satellite operating parameters and varying weather conditions.

LNB Power

In the default configuration, the TDR6 does not supply DC power to the LNB. However, the TDEM6110 can be configured so that the active LNB IN port outputs LNB DC power at <500 mA DC at either 13V or 18V.

TIERNAN
A Radyne ComStream Company

Front Panel

This chapter describes the following TDR6 front panel information:

- Components
- Navigating through menus
- Description of menus, parameters, and options

Front Panel Components

The front panel enables you to easily and efficiently configure and monitor the TDR6.
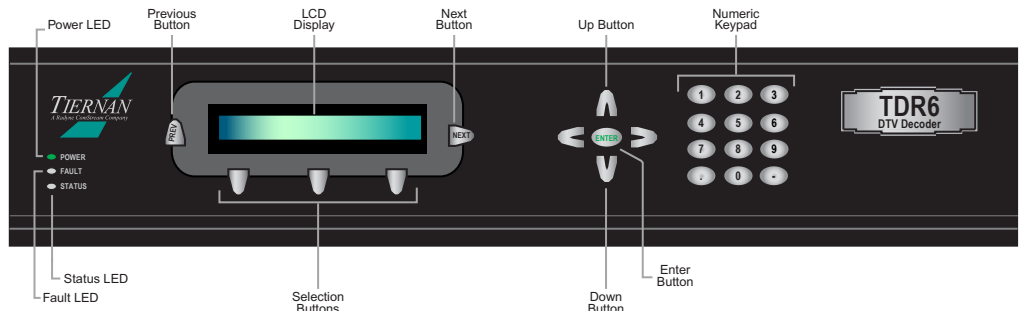
TDR6 Front Panel

- LED indicators – alert you to power, fault, and status conditions
- Previous button – used to scroll up to a previous menu level or leave a parameter without changing it's option
- LCD – displays menus, parameters, information, and messages
- Selection buttons – used to select the item displayed directly above the button
- Next button – used to scroll within the current menu level, or to scroll forward through a list of parameters
- Up and Down buttons – used to scroll through parameter *options* and increase and decrease parameter *values*
- Left and Right buttons – only available when entering alphabetic characters for *BISS* mode commands
- Enter button – used to issue a command or set a parameter
- Numeric keypad – used to enter numeric values; also used to enter alphabetic characters for *BISS* mode commands

TDR6 Menu   The following menu structure shows the standard TDR6 menus. Your front panel menus may vary depending upon the option modules installed in the unit.

TDR6 DTV Receiver/Decoder Menu Structure

Main Menu	Submenus			Functions/Parameters
Config	Default			Restore
	User			Restore • Save
Details	Input[1]	Config	Select	Input
			Demod — RF_A to RF_D	Modulation • RF Freq • LO Freq • Code Rate • Sym Rate • Data Rate • LNB Power • Acq Range
			Filter	PCR Filter
		Status	RF	Eb/No • Offset • Demod • Decoder • Transport • Rate • Raw BER • BER • Rx Level • Peak Jitter
			ASI	Signal • Transport • Rate • Peak Jitter
	Service			Number • Auto Select
	Video — Slot_1 to Slot_5[2]		Std Vid	PID • Mode • PAL Submode • Setup 7.5 IRE • Tiernan Closed Cap • Delay • Chroma
			HD Vid	PID • Format • Frame Rate • Delay • Chroma
	Audio — Slot_1 to Slot_5[3]	Audio_A to Audio_F		PID • Source • Channel Mode • Volume • Preferred • Delay • Sample Rate • Data Rate
	Data — Data_A and Data_B[4]			PID • Source • Interface • Handshake • Config Mode • Baud • Data Bits • Parity • Stop Bits
	VBI — Format			VBI Format • VBI Fmt Cntrl
	PGCA			Status
	BISS			Status • 1 Key • E Key • E ID • BISS Mode
Faults	Current			<list of current faults>
	History			<list of previous faults>
	Clear			"Press ENTER to Clear"
Control	FP_Lock			State • Password
	EIA-232			Baud • Data Bits • Parity • Stop Bits • Soft Flow • Hard Flow
	Network			Address • Mask • Gateway • MAC
	Clock			Date • Time
	Reset			"Press ENTER to Reset"
Version				Firmware

1. Options on the Input menu correspond to the input type selected.
2. Options on the Video menu correspond to the type of video: HD or SD.
3. Options on the Audio menu correspond to the type of audio: HD or SD.
4. Options on the Data menu correspond to the type of data: synchronous or asynchronous.

Navigating Through the Menus

The front panel LCD display and buttons were designed to help you navigate through the TDR6 menu structure quickly and efficiently.

LCD Display

LCD Symbols

There are four important symbols that appear on the LCD:

- Arrow ($\rightarrow$)
- Asterisk (*)
- Equal sign (=)
- Colon (:)

Arrow   As you are navigating through the TDR6 menus, an arrow will often display on the LCD. Depending upon where you are in the menu structure, this arrow denotes the following information:

- At a menu level the arrow indicates that there are additional items available at that current menu level
- In a list of parameters the arrow indicates that there are additional items available in that parameter list

Asterisk   While the TDR6 is executing a command or setting a parameter, an asterisk (*) appears on the LCD, indicating that the TDR6 is processing information. When the asterisk disappears, the process is complete.
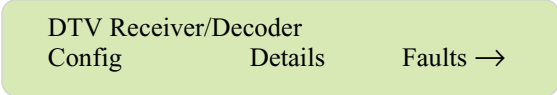
Equal Sign   Most parameters, though not all, can be modified in order to configure the TDR6. Configurable parameters are followed by an equal sign, denoting that the parameter option can be modified.

Colon   There are some parameters that are automatically set for your system or that are query-only parameters. These type of parameters are followed by a colon. When a parameter is followed by a colon, that parameter can be viewed but not changed.

LCD Text Formats

All menus, parameter options, and system information are displayed on the front panel LCD.

Menus   All menus are displayed in the following format.

DTV Receiver/Decoder		
Config	Details	Faults $\rightarrow$

- The first line identifies the current menu level, in this example, the main menu labelled DTV Receiver/Decoder.
- The second line identifies the available menu options.
- The arrow, when displayed, signifies that there are additional menu options available at that level.

Parameter Options   All parameter options are displayed in the following format.

Data A Menu
Baud=   38400 bps →

- The first line identifies the current menu level, in this example, the Data A menu.
- The second line displays the parameter, Baud, and its current setting of 38400 bps.
- The equal sign (=) denotes that this parameter can be modified. If this parameter was followed by a colon (:) the parameter would be view-only.
- The arrow indicates that additional User Data A parameters can be scrolled to by pressing the Next button.

Information   Information, such as current faults, faults in the history log, and system messages are displayed as ASCII text strings as shown in the following example.

Current Faults
DC Input Signal Loss

- The first line identifies the type of information displayed, in this example, current faults.
- The second line lists one line of information, in this example, the most recent current fault.
- There is *no* arrow displayed, signifying that there are *no* additional current faults.

Front Panel Navigation Buttons   The following front panel buttons are used to move through menus in order to issue commands and view status and fault information:

- Next
- Previous
- Selection
- Up and Down
- Enter
- Numeric keypad

Next Button   The Next button can be used when a right arrow is displayed on the LCD. The Next button moves you through the menu structure in the following manner:

- At a menu level, the Next button scrolls forward through all available menu items at that current level. When the last menu item is displayed, the TDR6 begins scrolling through the list again. The following graphic illustrates how the Next button functions at a menu level.

Press Next
System Displays
Next Group of Menu Items

Press Next;
System Returns to
Beginning of Menu

DTV Receiver/Decoder Menu
Config   Details   Faults ⟶

MPEG2 Receiver/Decoder Menu
Control   Version   ⟶
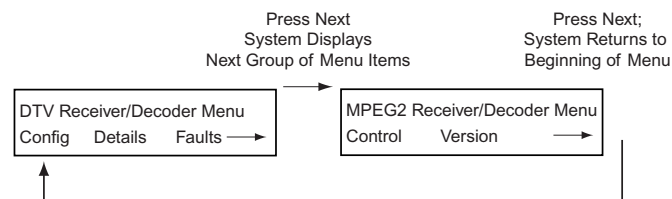
- In a parameter list, the Next button scrolls forward, one parameter at a time, through all parameters. When the last parameter is reached, the TDR6 scrolls through the list again.

LCD Display

```
Demodulator Menu
  RF Freq      11210 Mhz  ─────→   Press Next;  Next Parameter Displays
  LO Freq      10000 Mhz  ─────→   Press Next;  Next Parameter Displays
        ●                                ●
        ●                                ●
  Modulation   QPSK       ─────→   Press Next;  System Returns to
                                   First Parameter
```
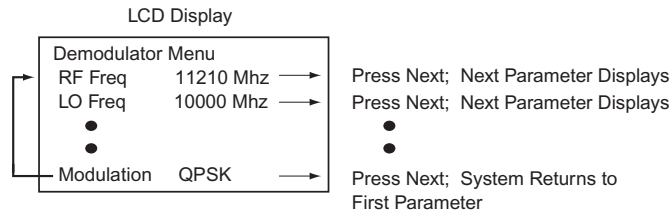
Parameter lists can only be scrolled through in a forward motion. If you accidentally scroll past the required parameter, you *cannot* backup using the Previous button; the Previous button will move you out of the parameter list up to the previous menu level. Instead, continue to press the Next button until the required parameter displays again.

Previous Button   The Previous button moves you through the menu structure in the following manner:

- At a menu level, the Previous button moves you up one menu level.

- In a parameter list, the Previous button moves you up to the previous menu level.

```
DTV Receiver/Decoder Menu
Config   Details     Faults  ─────→  ←───────┐
                                              │  Press Previous From any Menu;
                                              │  System Returns to the
         Control Menu                         │  Previous Menu Level
         Clock     Reset     ─────→  ←────────┘

                     Clock Menu
                     Date          05/26/2003  ─────→
                  {  Time          14:23:46    ─────→
Press Previous From any Parameter;
System Returns to the Previous Menu Level
```
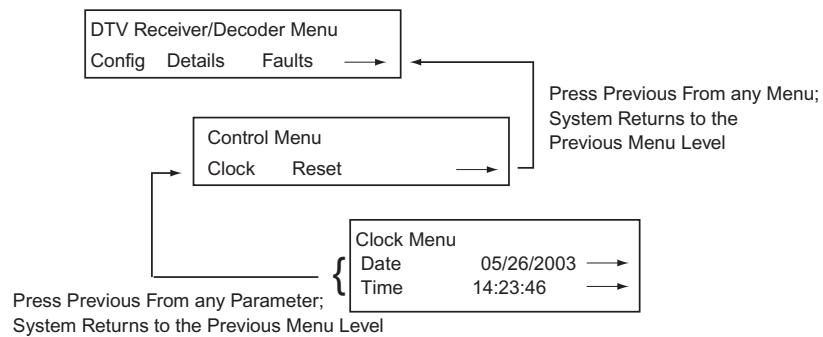
Select Buttons   The three Selection buttons are used to select the menu item or parameter option displayed on the LCD. To select the displayed item, press the Select button located directly below it. The Select button performs the following tasks:

- At a menu level, the Select button moves you to the selected submenu

- In a parameter list, the Select button causes the parameter and it option to flash, indicating that you can modify that parameter's option.

  Once the parameter is flashing, you can continue to press the select button to scroll through the list of available options. However, for those options that require a numeric value, the value must be entered using the numeric keypad — the selection buttons will not increment a numeric value.

Up and Down Buttons   The Up and Down buttons are not labeled, but are located above and below the Enter button, respectively. Once a **parameter** is selected, use the Up and Down buttons to scroll through its available options. If the option is a numeric value, the Up and Down buttons can be used to increase and decrease the numeric value.

Enter Button   The Enter button is used to issue a command, such as the clear history log command, or to set a parameter option, such as a video delay. The Enter button performs the following tasks:

- When the required command is displayed, the Enter button executes the command.

- When a parameter value is correctly displayed, the Enter button configures the system with the new parameter value. The new values are then stored in nonvolatile memory.

Numeric Keypad   The keypad is used to enter a numeric parameter value. When entering numeric values with the keypad, the Up and Down buttons can be used to correct errors:

- The Up button changes the value to 0; the correct value can then be entered

- The Down button deletes the numbers, from right to left; the correct value can then be entered

Alpha-numeric Entries

The alpha-numeric keypad is enabled when entering BISS Key and BISS ID command parameters. To correct any alpha-numeric characters, use the left arrow to delete the characters. To copy and insert the last character entered, press the right arrow key.

Alphabetic Entries — when entering values in an alpha-numeric field, the following alphabetic and numeric characters are displayed when a key is pressed:

Key	Character Displayed
1	. , ? ! - 1
2	A B C 2
3	D E F 3
4	G H I 4
5	J K L 5
6	M N O 6
7	P Q R S 7
8	T U V 8
9	W X Y Z 9
0	*space* 0 ' +

The first press of a number key displays the first character in the set; sequential presses of the same key advance through the character set, in a circular fashion. The cursor is advanced by either pressing another number key, or by pressing the right arrow key. For example to enter the word ALL which has two characters in the same characters set, the following keys would be pressed:

- 2   selects A
- 555   selects L
- →   advances the cursor so the next letter can be selected
- 555   selects L

A space can be entered by either a single press of the "0" key. For example, to enter the words *LA Default* the following keys would be pressed:

- 555   selects L
- 2   selects A
- 0   selects space
- 3   selects D
- →   advances the cursor so the next letter can be selected
- 33   selects E
- →   advances the cursor so the next letter can be selected
- 333   selects F
- 2   selects A
- 88   selects U
- 555   selects L
- 8   selects T
- Enter to issue the command

Issuing Commands

To issue a command from the front panel, perform the following steps:

1. Navigate to the required command or parameter using the Next and Selection buttons.

2. Select the parameter to be modified. The parameter and its option will begin to flash.

3. Change the parameter option as required:

   ❑ If the available options appear in a list, scroll through the list using the Up, Down, or Select buttons.

   ❑ If the option requires a numeric value to be entered, enter the value using either the Up and Down buttons to increment the value or using the numeric keypad to type in the value.

4. Issue the command by pressing the Enter key. An asterisk will briefly display and then disappear when the system is finished processing the request. The parameter, with its updated value, is then displayed and does not flash.

   ❑ If the Enter button is not pressed, the parameter is not changed.

   ❑ While the TDR6 is reconfiguring the parameter to the new value, the front panel is temporarily disabled.

The TDR6 configuration files are stored in non-volatile memory. When the TDR6 configuration is changed using the front panel, the changes are automatically stored in non-volatile memory. The TDR6 automatically restores to the saved configuration whenever the unit is reset or powered up.

Correcting Mistakes

Selecting Options from a List   If you are selecting a parameter from a list, and have *not* pressed the Enter button, use the Up or Down buttons to scroll to the correct option.

Using the Keypad   If you are **entering a value** with the keypad, and you have *not* pressed the Enter button, you can either:

- Press the Up button to change the value to 0, then enter the correct value

- Press the Down button to delete the numbers (from right to left), then enter the correct value

Leaving a Parameter   If you have not pressed the Enter button, you can leave a parameter without modifying it by pressing either the:

- Previous button which returns you to the previous menu level
- Next button which advances you to the next parameter in the list

In either situation, the TDR6 will ignore any values entered and return the parameter to its original setting.

After Pressing the Enter Button   If you accidentally issue an incorrect parameter value to the TDR6, you can correct the error by:

1. Selecting the parameter again using the Selection buttons. The parameter will begin to flash.
2. Change the parameter option to the correct value.
3. Issue the parameter again by pressing the Enter button

Example

The following example describes how to move through menus and select options. In this example, the video mode will be set to NTSC. This example applies to the video card located in slot 2, and is for standard definition video.

1. From the DTV Receiver/Decoder main menu, select Details.

> DTV Receiver/Decoder
> Config   Details   Faults $\rightarrow$

2. From the Low Level Setup menu, select Video.

> Low Level Setup
> Input   Service   Video $\rightarrow$

3. From the Video Decoder menu, select Slot 2.

> Video Decoder Menu
> Slot 2

4. From the Slot 2 Video menu, select standard definition.

> Slot 2 Video Menu
> Std_Vid

5. The Standard Definition Video Decoder menu displays, showing the first video parameter and it's current setting. Press Next to scroll to the next parameter.

> Std Video Decoder
> PID =   33 $\rightarrow$

6. The Mode parameter and its current setting display.

```
Std Video Decoder
Mode =                          PAL →
```
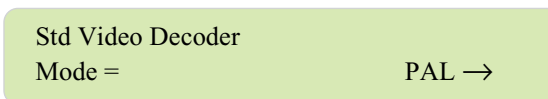
7. Press the Select button under the PAL option. The parameter begins to flash.
8. Scroll to the NTSC parameter using the Up, Down, or Select button.

```
Std Video Decoder
Mode =                          NTSC →
```
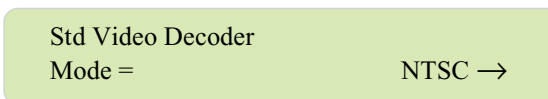
9. Press the Enter button. When the parameter stops flashing, the TDR6 has set the new video mode.

Menu Descriptions

A complete description of all TDR6 menus is provided in this section. The menus actually available depend on the specific option modules installed in your unit.

Command	Description	Parameters / Response Values
Configuration Menu: consists of two submenus, Default and User, which enable you to quickly and easily re-initialize the unit using predefined factory default configuration settings or your own user-defined configuration settings.		
Configuration>Default: predefined configuration sets allow common operating modes to be stored in the unit at the factory, or at a customer depot, and then easily recalled and implemented on-location in field operations. These configuration sets are not altered by reset, power cycling, or factory DVB default setting of the decoder.		
Restore	Initializes the TDR6 using the pre-defined factory configuration parameters	■ Default1 ■ Default2 ■ Default3 ■ DVB
Configuration>User: used to save and restore site-specific configuration parameters in non-volatile memory and then recall these stored parameters in order to re-initialize the TDR6 when your site requirements change.		
Restore	Initializes the TDR6 using the selected user-stored, site-specific parameters	User1, User2, User3
Save	Saves the current site-specific configuration in non-volatile (flash) memory under the selected option	User1, User2, User3
Details Menu: enables you to configure the input, services, video, audio, data, and conditional access for the TDR6		
Details>Input>Config>Select: used to select the type of input for the TDR6		
Input	Selects the input source for the TDR6	■ ASI: selects the external ASI input source ■ RF_A, RF_B, RF_C, RF_D: selects the TDR6 internal demodulator as input source; selects the option that corresponds to the LNB port you want to be the active port
Details>Input>Config>Demod>RF: allows you to configure or query the demodulator parameters; the RF menu appears only if an RF input has been selected using the Details>Input>Config>Select menu. **Each of the four RF inputs, A through D, can be independently configured, although only one may be active at one time.**		
Modulation	Sets the modulation type.	QPSK, 8PSK, 16QAM
RF Freq	Sets the RF frequency for the QPSK demodulator **Note**: The IF frequency is the absolute value of the difference between the RF frequency and the LO frequency. The demodulator has a valid IF frequency in the range of 2150 MHz and 950 MHz. Entering values for RF or LO that equal an out of range IF frequency value will result in an IF value that is either the maximum or the minimum IF frequency.	950 to 2150MHz above or below your local oscillator frequency

Command	Description	Parameters / Response Values
LO Freq	Sets the frequency to match your LNB downconverter local oscillator frequency. **Note**: The IF frequency is the absolute value of the difference between the RF frequency and the LO frequency. The demodulator has a valid IF frequency in the range of 2150 MHz and 950 MHz. Entering values for RF or LO that equal an out of range IF frequency value will result in an IF value that is either the maximum or the minimum IF frequency.	2000 to 15000 MHz
Code Rate	Sets the Viterbi code rate	■ QPSK: 1/2, 2/3, 3/4, 5/6, or 7/8 ■ 8PSK: 2/3, 5/6, 8/9 ■ 16QAM: 3/4, 7/8
Sym Rate	Sets the demodulator to the frequency of the incoming RF signal. **Note**: If an out-of-range value is entered the TDR6 will not accept the new value and will revert to the previous value entered. Since the data rate is proportional to the symbol rate, entering a data rate value might fail if the corresponding symbol rate is out of range. Converting a symbol rate to data rate and vice versa may be subject to a small rounding error. The error is less than 0.00001%. It is advisable to use the symbol rate representation when entering parameters if a conversion error cannot be tolerated. In cases where the demodulator is not locking on the carrier, it is necessary to add an offset to the symbol rate. This compensates for the symbol rate drift. The range of the offset is between 0.0002% and 0.0006%; in general a value of 0.0004% proves successful to lock on the carrier in these cases.	37500000 sps and 1000000 Sps To convert symbol rate to data rate, use the following equation: Symbol rate x 2 x (188/204) x FEC code rate
Data Rate	Sets the data rate of the transport data stream	2 to 48 Mbps To convert data rate to symbol rate, use the following equation: Data rate x 1/2 x (204/188) x 1/FEC code rate
LNB Power	Sets the voltage of the LNB	Off, 13 V, 18 V
Acq Range	Defines the size of the frequency range over which the demodulator will search for the carrier.	0 to 7500000 Hz
Details>Input>Config>Filter: allows you set the PCR filter		
PCR Filter	Sets the PCR (program clock reference) filter for normal operations or operations over an ATM network.	■ Normal: set for normal operations ■ ATM: set for operations over an ATM network
Details>Input>Status>RF: allows you to query the receive signal E_b/N_0 level, the carrier offset, and the current lock status of the demodulator, decoder, and transport stream; this menu only applies to the currently active RF input.		
E_b/N_0	Query-only; displays the E_b/N_0 of the RF receive signal **Note:** E_b/N_0 is only available when Details>Input>Config>Select>Input is set to RF.	Displays the value in dB; value is ± 2 dB Eb/No values above 16 dB are not significant.
Offset	Query-only; displays the RF offset. The Offset measures the difference, in MHz, between the actual carrier frequency received by the TDR6 and the carrier frequency the TDR6 calculates by subtracting the LO parameter from the RF parameter. For optimum performance, the Offset parameter should be as close to zero as possible. For more information regarding the offset, refer to the chapters on configuration and troubleshooting. Also refer to the appendix on the QPSK demodulator. **Note:** Offset is only available when Details>Input>Config>Select>Input is set to RF.	Frequency in MHz
Demod	Query-only; displays the lock status of the demodulator Note: Demod is only available when Details>Input>Config>Select>Input is set to RF.	Locked, Unlocked
Decoder	Query-only; displays the lock status of the decoder **Note:** Decoder is only available when Details>Input>Config>Select>Input is set to RF.	Locked, Unlocked
Transport	Query-only; displays the lock status of the transport stream	Locked, Unlocked
Rate	Query-only; displays the output rate for the QPSK demodulator	value in bps

Command	Description	Parameters / Response Values
Raw BER	Query-only; displays the raw bit error rate; this rate is the error rate of the signal as it is received from the satellite, before error correction is applied.	—
BER	Query-only; displays the bit error rate; this value represents the number of errors detected in the signal after error correction is applied. This rate should be a zero for correct performance.	—
Rx Level	Query-only; displays the power level of the input signal.	value in .dBm
Peak Jitter	Query-only; displays the difference, or jitter, between the STC and PCR clocks.	value in ns
Details>Input>Status>ASI: allows you to query the presence of the ASI signal, as well as other transport stream parameters		
Signal	Query-only; displays if the ASI signal is present or not **Note:** Signal is only available when Details>Input>Config>Select>Input is set to ASI.	Present, Absent
Transport	Query-only; displays the lock status of the transport stream	Locked, Unlocked
Rate	Query-only; displays the output rate for the QPSK demodulator	value in bps
Peak Jitter	Query-only; displays the difference, or jitter, between the STC and PCR clocks.	value in ns
Details>Service: consists of two submenus, Number and Auto Select, which enable you to query and select the services available in the transport stream. **Once you have selected a service, the Video Decoder, Audio Decoder, and User Data menus display the PIDs available for the selected service.**		
Number	Selects a service from those available in the transport stream. Once a service is selected, the TDR6 processes that service until: ■ Another service is selected *or* ■ The selected service is no longer available in the transport stream	Displays a list of available services. ■ Each available service in the transport stream consists of a program number, a service name, and a service provider. ■ If the transport stream does not contain service names and providers, only the program numbers are displayed. ■ If the transport stream input is not connected, or if it lacks PSI information, the LCD displays the message: *No services available*.
Auto Select	Determines which service, including audio and data services, that the TDR6 will select when any of the following events occur: ■ The TDR6 power is turned off and then restored, or the unit is reset ■ The TDR6 loses and then re-establishes lock on the transport stream ***Note***: Since the typical SCPC transmission consists of a single service that includes of a single video/audio pair, the Auto Select feature was added to simplify the configuration process for typical SCPC users. When the Auto Select feature is enabled, or set to On, the decoder automatically selects the service with the lowest service number first, then selects the video component with the lowest PID, and finally selects the audio components with the lowest PIDS for audio A/B. With Auto Select set to Off, the decoder can be configured to process a particular service, and within that service, to process selected video and audio services.	■ On – when Auto Select is set to On, the TDR6 automatically selects the first available service in the transport stream. ***Note***: If you change the Auto Select function to On after you have selected a service, the TDR6 will continue to process the service you selected until one of the events occurs, then the TDR6 selects the first available service in the transport stream. ■ Off – when Auto Select function is set to Off, the TDR6 searches the transport stream for the last service you manually selected. If the service is found in the transport stream, the TDR6 selects the service, and the LCD displays the program number, service name, and service provider. If the service is not found in the transport stream, the LCD displays *Service Not Available*, the TDR6 does not select a service, and no video, audio, or user data will be output.

Command	Description	Parameters / Response Values
Details>Video Menu: used to configure the TDR6 video. **To configure the video, you must first select the video slot that corresponds to the video option card you want to configure.** **Once you have select the slot, you can set the video parameters for your site requirements.** *Note*: **The options on the slot menu depend on the specific configuration of the TDR6.**		
Details>Video>Standard Video: enables you to set the parameters for standard video. This menu only appears if the TDR6 has a standard video option module installed. **The TDR6 auto-sensing video decoder automatically changes the video parameters to match the incoming signal**		
PID	Selects or displays the video PIDs available in the current service	Video PIDs available in the selected service. If no video PIDs are present, the system displays `no video present`. To disable video output, select the `video off` option.
Mode	Sets the video format	NTSC, PAL, AUTO
PAL Submode	Sets the video PAL Submode when Mode = PAL	B, D, G, H, I
Setup 7.5 IRE	Selects the Setup 7.5 IRE mode	On, Off, Auto
Tiernan Closed Cap	Providing that line 21 closed captioning is available in the selected service, this command determines whether line 21 will be included in the video output stream. **Note**: Closed Captioning is only available when video>standard definition>mode is set to NTSC.	■ On – line 21 data will be included When Closed Captioning set to On, the Vert Offset is automatically set to -1. ■ Off – line 21 will not be included Default: Off
Delay	Sets the delay between the time the video data is received and the time the video data is sent to the video output port. Delay is provided primarily for interoperability with other manufacturers' equipment. It is not normally necessary to enter a non-zero delay value.	-1000 to +1000
Chroma	Query-only; displays the video chroma format for the video input transport stream.	n/a, 4_2_0, 4_2_2, 4_4_4
Details>Video>High Definition>Video: allows you to configure and query video parameters using the PID, format, delay, and frame rate options. This menu only appears if the TDR6 has a high-definition video card module installed. **The TDR6 auto-sensing video decoder automatically changes the video parameters, with the exception of the delay parameter, to match those of the input signal. The video delay must be set manually.**		
PID	Selects or displays the video PIDs available in the current service.	Video PIDs available in the selected service. If no video PIDs are present, the system displays `no video present`. To disable video output, select the `video off` option.
Format	Query-only; displays the video format	1080I, 720P
Frame Rate	Query-only; displays the video frame rate, which is auto-detected by the TDR6	■ 29.97 fps and 30 fps for 1080I formats ■ 59.94 fps and 60 fps for 720P formats
Delay	Sets the delay between the time the video data is received and the time the video data is sent to the video output port. Delay is provided primarily for interoperability with other manufacturers' equipment. It is not normally necessary to enter a non-zero delay value.	-1000 to +1000
Chroma	Query-only; displays the video chroma format for the video input transport stream.	n/a, 4_2_0, 4_2_2, 4_4_4

Command	Description	Parameters / Response Values
Details>Audio: used to configure the TDR6 audio.		
To configure the audio, you must first select the audio slot and port that corresponds to the audio option card you want to configure.		
The Audio menu contains submenus for each audio port on the selected option card based on the following:		
■ **If only a TDEC-6100 option module is installed, audio ports A and B display**		
■ **If only a TAUD-6100 option module is installed, audio ports A to D display.**		
■ **If both option modules are installed, audio ports A, B, C, and D correspond to the audio ports located on the TAUD6100 board, while audio ports E and F correspond to the audio ports located on the TDEC-6100 option module.**		
Each menu for the selected audio port has identical parameters and options which allow you to monitor and control the individual audio ports. However, options vary depending on whether the audio is SD or HD.		
Once you have selected the port, you can set the audio parameters.		
Note: **The options on the slot menu depend on the specific configuration of the TDR6.**		
Note: **The TDR6 auto-sensing audio decoder automatically changes the audio parameters, with the exception of the delay parameter, to match those of the input signal. The audio delay must be set manually.**		
PID	Selects or displays the audio PIDs and their associated language codes for the selected service.	Audio PIDs available in the selected service. If no audio PIDs are present, the system displays `no audio present`. To disable audio output, select the `audio off` option.
Source	Query-only; displays the input audio source for the currently selected PID	MPEG-2, Uncompressed, ATSC
Channel Mode	Sets the audio format of the output audio channel **Note:** Channel Mode is only available when the audio source is MPEG-2.	■ Left: selects the audio stream from the left channel and supplies it to both the audio left and audio right outputs ■ Right: selects the audio stream from the right channel and supplies that stream to both the audio right and audio left outputs ■ Stereo: Supplies both mono streams to the audio left and right outputs exactly as sent by the encoder
Volume	Sets audio volume for analog audio output. The TDR6 cannot increase or amplify the incoming audio level. If the volume is set to 18 dBu, the output volume equals that of the input signal level. If you set the audio volume to a value less than 18 dBu, the TDR6 attenuates the input signal level. **Note:** Volume is only available when the audio input is analog.	0 - 18 dBu
Preferred	Selects the designated language from the languages available in the selected service	English, Russian, Spanish, French, German, Dutch, Italian, Portuguese, Korean, Japanese, Chinese, Arabic, Malayalam
Delay	Sets the compressed audio bit stream buffer delay, which controls the amount of time delay between the audio and video	-1000 to +1000 milliseconds; default is zero, which is no delay Delay is primarily provided for interoperability with other manufacturers' equipment; it is not normally necessary to use a non-zero delay value
Sample Rate	Query-only; displays the audio sample rate. Only available in MPEG audio mode.	n/a, 0, 32, 44.1, 48
Data Rate	Query-only; displays the audio data rate.	0 to 640
Details>Data: used to set the user data options; options are different for asynchronous or synchronous data.		
PID	Selects the data channel	Available user data PIDs. If no data PIDs are present, the system displays `no data present`. To disable data output, select `data off` option.
Source	Query-only; displays the encoder data channel parameter settings	Encoder settings of the user data channel
Interface	Sets the hardware interface	RS-232, RS-422

Command	Description	Parameters / Response Values
Handshake	Sets the handshaking parameter for the user data port.	■ On: Enables handshaking for the specified user data port ■ Off: Disables handshaking for the specified user data port
Config Mode	Setting determines how the user data parameters are set.	■ Auto: TDR6 automatically configures the user data parameters to match those of the incoming transport stream ■ Manual: all user data parameters must be manually set by the operator
Baud	Sets the baud rate for the data channel	■ Asynchronous: 1200, 2400, 4800, 9600, 19200, 38400 ■ Synchronous: 0 - 4.096 Mbps
Data Bits	Sets the character length for the asynchronous data channel	7, 8
Parity	Sets the parity for the asynchronous data channel	None, Even, Odd
Stop Bits	Sets the number of stop bits for asynchronous data channel	1, 2
Details>VBI>Format: used to set the VBI parameters; for additional information on VBI, refer to the appendix on VBI data transmission.		
VBI Format	When VBI Fmt Cntrl is set to Auto, this parameter is query-only; the TDR6 automatically detects and processes the incoming VBI data. When VBI Fmt Cntrl is set to Manual, this parameter is used to set the type of VBI format to be decoded and included in the video output stream.	■ Off – no VBI information will be included in the video output stream ***Note***: VBI Fmt Cntrl must be set to manual for this parameter to be set to off. ■ TiernanCC – sets the VBI format to Tiernan proprietary closed captions ■ Lines16 – sets the VBI format to expanded windows, 16 lines ■ Lines32 – sets the VBI format to expanded windows, 32 lines
VBI Fmt Cntrl	Setting determines if the TDR6 will automatically detect, decode, and include the VBI data in the output stream, or if the user will manually set all parameters.	■ Auto – the TDR6 automatically determines the type of incoming VBI data, decodes it and includes it in the output stream ■ Manual – enables you to manually set the VBI format to be decoded and included in the video output stream.
Details>PGCA: queries the protection and authorization status of a signal		
Status	Query-only; displays if the selected service is PGCA protected	■ PGCA_Enabled ■ In_the_Clear
Details>BISS: used to set the BISS mode and associated key and ID values. The key and ID values should be obtained from the site operator who has set-up the encryption at the encoder site. **The front panel numeric keypad has been enhanced to provide alpha-numeric entries for the 1KEY, EKEY, and EID parameter entries. For additional information on alpha-numeric entries, refer to the appropriate section in this supplement.**		
Status	Query-only; displays the state of the incoming transport stream.	■ Scrambled: the incoming transport stream is scrambled ■ Not_scrambled: the incoming transport stream is not scrambled
1Key	Sets the key value for BISS 1 mode. The 1Key value is also referred to as the *clear session word*. ***Important Considerations when entering BISS 1KEY:*** ■ This command must be set before BISS Mode1 is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* The value cannot be displayed once it is entered. Instead, the TDR6 will display 12 asterisks.	■ The *value* is a 12 character hexadecimal value, ***that does not begin with 0x*** ■ If less than 12 characters are entered, the TDR6 will not set the command. ■ If more than 12 characters are entered, the TDR6 truncates the value to the first 12 characters entered.

Command	Description	Parameters / Response Values
EKey	Sets the key value for BISS E mode. The E key value is also referred to as the *encrypted session word*. ***Important Considerations when entering BISS EKEY:*** ■ This command must be set before BISS ModeE is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* ■ The value cannot be displayed once it is entered. Instead, the TDR6 will display 16 asterisks.	■ The *value* is a 16 character hexadecimal value, ***that does not begin with 0x*** ■ If less than 16 characters are entered, the TDR6 will not set the command. ■ If more than 16 characters are entered, the TDR6 truncates the value to the first 16 characters entered.
EID	Sets the identification value for BISS E mode. The E ID value is also referred to as the *Injected ID*. ***Important Considerations when entering BISS EID:*** ■ This command must be set before BISS ModeE is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* ■ The value cannot be displayed once it is entered. Instead, the TDR6 will display 14 asterisks.	■ The *value* is a 14 character hexadecimal value, ***that does not begin with 0x*** ■ If less than 12 characters are entered, the TDR6 will not set the command. ■ If more than 14 characters are entered, the TDR6 truncates the value to the first 14 characters entered.
BISS Mode	Sets the BISS mode that will be used to descramble the incoming transport stream. ***Note***: Before setting this command to mode1 or modeE, the appropriate KEY and ID values must first be entered. ***Note***: There may be a slight delay in the picture when setting or changing BISS modes. This occurs when the signal is routed to the descrambling module. ***Note***: To ensure proper BISS operations, ensure that PGCA is set to Off.	none, mode1, modee Default: none
Faults Menu: consists of three submenus: Current, History, and Clear, which are used to view current faults and fault history log and to clear the fault history log. **The TDR6 performs fault detection and reporting on a real-time basis. When the TDR6 detects a fault, a description of the fault is reported to the current fault log. The fault is also reported to the fault history log, where it is stored.** **The status of the TDR6 can be quickly determined by checking the front panel LEDs. If any fault LEDs are illuminated, the TDR6 can be queried for additional information using the Faults menu.**		
Current	Query-only; displays the current fault log. The current fault log only retains and reports fault conditions present at the time of the fault query; prior fault conditions are not retained or reported here. Current faults are reported in order of occurrence, beginning with the most recent.	Displays a list of current faults
History	Query-only; displays the fault history log. The fault history log retains all faults that have occurred since the TDR6 was powered on, the TDR6 was reset, or the fault history log was cleared. Faults are time stamped, using the TDR6 internal clock, to help you monitor system performance and diagnose problems. Faults are listed in order of occurrence, beginning with the most recent.	Displays a list of faults stored in the fault history log; faults are time stamped.
Clear	Clears the fault history log. The fault history log is also cleared when the TDR6 is reset or powered-off.	After faults are cleared, LCD displays Fault menu
Control Menu: allows you to control the TDR6 hardware; submenus are FP_Lock, EIA-232, Network, Clock, and Reset.		
Control>FP_Lock: used to query and change the status of the front panel		
State	Sets the state of the front panel	■ Locked – disables the front panel; the front panel can only be used to view status and configuration parameters ■ Normal – the front panel is unlocked and can be used to enter and change configuration parameters (default)
Password = 0	Unlocks the front panel; used in conjunction with the state command. `Password = 0` is only displayed when the front panel is set to locked	7384 (default)

Command	Description	Parameters / Response Values
Control>EIA-232: used to configure the remote port		
Baud	Sets the baud rate for the remote port	1200, 2400, 4800, 9600, 19200, 38400
Data Bits	Sets the number of data bits for the remote port	7, 8
Parity	Sets the parity for the remote port	None, Even, Odd
Stop Bits	Sets the number of stop bits for the remote port	1, 2
Soft Flow	Sets the software control for the data flow to on or off	■ On: if data flow is software controlled ■ Off: if data flow is not software controlled
Hard Flow	Sets the hardware control for the data flow to on or off	■ On: If data flow is hardware controlled ■ Off: If data flow is not hardware controlled
Control>Network: enables you to set the network parameters when the TDR6 is to be monitored and controlled through a network		
Address	Sets the Internet Protocol address of the TDR6	User defined in the format: xxx:xxx:xxx:xxx where xxx is a decimal number from 0 to 999 Example: 192:200:9:201
Mask	Query-only; displays the IP mask This parameter can be set using a remote terminal and the appropriate remote command.	text string default: 225.225.0.0
Gateway	Query-only; displays the IP router address This parameter can be set using a remote terminal and the appropriate remote command.	text string default: 0.0.0.0
MAC	Query-only; displays the ethernet hardware address of the TDR6	Format: xx:xx:xx:xx:xx:xx where xx is a hexadecimal number from 0 to f. Example: 00:e0:74:00:02:cb
Control>Clock: used to set the date and time		
Date	Sets the date. If the date is entered incorrectly, or an out-of-range value is entered, the TDR6 will display and continue to use the previously set date.	*mm.dd.yyyy* where: ■ *mm* = the month as a value between 1 and 12 ■ *dd* = the day as a value between 1 and 31 ■ *yyyy* = the year representing all four digits of the current year Default: 00.00.0000
Time	Sets the time.	*hh.mm.ss* where: ■ *hh* = hours, in 24-hour format, as a value between 0 and 23, (where 0 is midnight and 23 is 11 PM) ■ *mm* = minutes; value between 0 to 59 ■ *ss* = seconds; value between 0 to 59
Control>Reset: used to reset the TDR6 to the last-saved configuration set		
Press Enter to Reset	When a reset if performed, the following actions occur: ■ The last configuration that was set is restored, regardless of whether you saved this configuration using the User/Save options under the Stored Configuration menu. ■ All programmable logic and firmware are reloaded. ■ The unit is restarted. ■ The fault history log is cleared. **Additional Information:** As an aid to troubleshooting, the fault history log should be reviewed and recorded before resetting or turning the TDR6 power off.	Returns to the main menu after reset
Version Menu: displays the version of firmware currently in use on the TDR6		
Firmware	Query-only; displays the version of firmware currently in use on the TDR6	Displays the firmware version label

TDR6 Procedures This section provides detailed steps for performing various TDR6 tasks.

Restoring a Default Configuration

To restore a default configuration set:

1. From the DTV Receiver/Decoder menu, select Config. The Config menu displays.
2. Select Default. The Default Configuration menu displays.
3. Scroll through the list of parameters, select the appropriate option, and press Enter. The system will display `Initializing . . .`

   The configuration process may take 3 to 4 minutes. When the system has completed its configuration process, the LCD returns to the DTV Receiver/Decoder main menu.

> **NOTE** The operating parameters in use at the time the restore process is executed are overwritten and will be lost if not previously saved as a configuration set.

Restoring a User Configuration

1. From the DTV Receiver/Decoder menu, select Config. The Config menu displays.
2. Select User>Restore. The Restore User Configuration menu displays.
3. Scroll through the list of parameters, select the appropriate option, and press Enter. The system will display `Initializing . . .`

   The configuration process may take 3 to 4 minutes. When the system has completed its configuration process, the LCD returns to the DTV Receiver/Decoder main menu.

> **NOTE** The operating parameters in use at the time the restore process is executed are overwritten and will be lost if not previously saved as a configuration set.

Saving a User Configuration

To save a user-defined configuration set under an existing label:

1. Configure the TDR6 with the required parameters.
2. Once all parameters are correctly set, select Config from the DTV Receiver/Decoder menu. The Configuration menu displays.
3. Select User>Save. The Save User Configuration menu displays.
4. Scroll through the list of parameters, select the appropriate option, and press Enter.

   The configuration process may take 3 to 4 minutes. When the system has completed its configuration process, the asterisk will disappear.

> **NOTE** Any configuration parameters previously stored under the selected label will be overwritten once the save process is executed.

Locking the Front Panel

To lock the front panel:

1. From the DTV Receiver/Decoder menu, select Control. The Control menu displays.
2. Select FP_Lock. The Front Panel Access menu displays showing the status of the front panel: `State = Normal`.
3. Press the Up button once. The front panel displays `State = Locked`.
4. Press Enter. The front panel displays `Password = 0` indicating that the front panel is now locked.

Unlocking the Front Panel

To unlock the front panel:

1. From the DTV Receiver/Decoder menu, select Control. The Control menu displays.

2. Select FP_Lock. The Front Panel Access menu displays showing the status of the front panel: `Password = 0.`

3. Using the front panel keypad, type in the password and press Enter. The default password is 7384.

4. The front panel displays `State = Unlocked` indicating that the front panel is now unlocked.

If the wrong password is entered, the TDR6 displays `Password = 0`. If this occurs, use the front panel keypad to type in the correct password and press Enter.

Setting the Date

To set the date:

1. From the DTV Receiver/Decoder menu, select Control. The Control menu displays.

2. Select Clock>Date.

3. Use the keypad to type in the correct date, separating each category with a decimal point. The date is entered in mm/dd/yyyy format.

4. Press the Enter button.

If the date is entered incorrectly, or an out-of-range value is entered, the TDR6 will display and continue to use the previously set date.

Setting the Time

The hours are in a 24-hour format and must be set from 00 to 23, where 00 is midnight and 23 is 11 PM. For example, for 8 AM you would set the hours to 08, and for 8 PM you would set the hours to 20. Both minutes and seconds can be set from 00 to 59. To set the time:

1. From the DTV Receiver/Decoder menu, select Control. The Control menu displays.

2. Select Clock>Time.

3. Use the keypad to type in the correct hour, minutes, and seconds, separating each category with a period.

4. Press Enter.

Performing a System Reset

To reset the TDR6:

1. From the DTV Receiver/Decoder menu, select Control. The Control menu displays.

2. Select Reset and press Enter. The TDR6 is reset to the last configuration set; all programmable logic and firmware is reloaded; the unit is restarted; and the fault history log is cleared

Using a Remote Unit

4

In addition to the front panel, a remote unit can be used to configure and monitor the TDR6. The chapter presents the following information for remote command operation:

- Configuring remote software parameters
- Overview of remote communications
- Instructions for issuing remote commands
- Error messages
- Remote command listing

For remote cabling information, refer to Chapter 2.

NOTE

Any parameter changes made using a remote unit are not automatically stored in flash memory. When the TDR6 configuration is changed using a remote unit, an operational test should be performed to verify that the system is operating correctly. Then the new configuration should be saved by issuing the MC CONFIG SAVE command.

If the TDR6 is reset prior to issuing the MC CONFIG SAVE command, any changes made using the remote unit will not be restored. Instead, the TDR6 restores the last changes saved to flash memory. Once the configuration is saved using the MC CONFIG SAVE command, the TDR6 automatically restores the saved settings when the unit is reset or powered up.

Configuring Remote Software Parameters

Remote Port

After you have cabled the remote unit to the TDR6 remote port, perform the following steps to establish remote communications:

1. Configure the communications software parameters of your remote unit to match the following TDR6 remote port factory DVB default settings:
   - Baud rate = 38400 bps
   - Data bits = 8
   - Parity = none
   - Stop bits = 1

   Unless you change the remote control settings and save the changes in non-volatile (flash) memory, the TDR6 restores this list of default communications settings whenever the TDR6 is reset or powered-up.

2. Press the Enter key on the remote keyboard several times to generate a prompt (>) on the remote display. Once a prompt appears on the remote display, successful communication has been established between the TDR6 and the remote unit.

   Once communications are established, the remote port parameters can be changed to a faster operating speed.

3. If you are unable to generate a prompt on the remote unit, troubleshoot the remote unit installation and setup:
   - Ensure that the remote unit and the TDR6 are turned on and plugged into an active AC outlet

- Verify that the baud rate and parity of the remote unit communications package match the factory default setting of the TDR6 remote interface
- Verify that the cable between the terminal and the TDR6 is properly connected
- Power cycle the TDR6 if needed
- If the unit still fails to generate a prompt, contact Customer Service.

Ethernet Port

After you have cabled the TDR6 to a network through the TRD6 Ethernet port, perform the following steps to establish remote communications using Windows Telnet:

> **NOTE** More sophisticated applications are available that allow the user to view commands and responses more easily.

1. At the remote unit, access the remote unit command prompt (>) by selecting the MS-DOS Prompt.
2. At the > prompt, launch Telnet by typing `TELNET`. The Telnet window appears.
3. From the Connect menu, select Remote System. The Remote System dialog box appears.
4. For Host Name or IP Address, type the TDR6 IP address. For the procedure used to assign an IP Address, refer to the installation chapter.
5. For Port Type enter `21846` or `0x5556`.

> **NOTE** Do not select "Telnet." If you select "Telnet," the program will attempt to log you into the device operating system.

6. For Terminal Type, accept the default.
7. Click the Connect button. You should now be connected.
8. If connection is not successful, troubleshoot the installation and setup:
   - Ensure that the TDR6 is turned on and plugged into an active AC outlet
   - Verify that the cable between the terminal and the TDR6 is properly connected
   - In Telnet, verify that the correct IP address and port type have been selected
   - Check with the Information Systems to determine if problems exist with the LAN
   - If you need assistance, contact Customer Service.

Remote Communications Overview

The TDR6 can be configured, monitored, and controlled from a remote unit. The remote unit might be an ASCII terminal, a personal computer, or any other remote unit capable of asynchronous communications. The TDR6 supports ASCII protocol for remote communications.

Command Types

The remote unit accepts two different types of commands:

- Execute commands direct the TDR6 to perform a specified action, such as changing a configuration parameter.

Execute commands consists of a command mnemonic, which is followed by a space, the command instruction, a space, and the parameter.

```
                   mnemonic   instruction parameter
Command = {       ⏞         ⏞        ⏞
                   MC  RS232    BAUD      1200
```

- Query commands direct the TDR6 to display the current setting of a specific parameter or to display current status information.

  Query commands consists of a command mnemonic, which is followed by a space, and the command instruction. Query commands are issued by typing the command, without a parameter, and pressing Enter. The TDR6 responds to the query by displaying information on the remote display.

```
                   mnemonic      instruction
Command = {       ⏞           ⏞
                   MC  RS232       BAUD
```

The TDR6 uses the following command mnemonics to group various commands:

- AD – audio decoder commands

  The TDR6 can be configured with up to six separate audio channels based on the installed option cards. The ports are identified based on the following:

  - If only a TDEC-6100 option module is installed, analog audio ports A and B can be configured.
  - If only a TAUD-6100 option module is installed, digital audio ports A to D can be configured.
  - If both option modules are installed, audio ports A, B, C, and D correspond to the digital audio ports located on the TAUD-6100 board, while audio ports E and F correspond to the analog audio ports located on the TDEC-6100 option module.

- DC – decoder services management commands allow you to configure various decompressor/decoder control operations.
- DMD – demodulator commands allow you to configure each of the four LNB input ports and to display receive signal status information. For DMD commands, a period must be entered to separate the mnemonic from the channel designator.

  - demodulator A (DMD**.**A) — used to configure LNB A
  - demodulator B (DMD**.**B) — used to configure LNB B
  - demodulator C (DMD**.**C) — used to configure LNB C
  - demodulator D (DMD**.**D) — used to configure LNB D

- Fault commands enable you to query faults and clear the fault history.
- HD – high-definition video decoder commands allow you to display or set the HD video operating parameters.

- MC – enable you to display or set various master controller functions including the remote control interface, nonvolatile configuration memory, date and time settings, and network setup.
- PGCA – Tiernan's conditional access commands allow you to display a signal's protection and authorization status.
- UD – user data commands

  The TDR6 can be configured for two separate user data channels, which are referred to as user data channel A and user data channel B.

  - UDA channel controls user data channel A.
  - UDB channel controls user data channel B.
- VD – Video decoder commands allow you to display or set operating parameters for standard-definition video.

Issuing Remote Commands

To issue a command from a remote unit, type the command at the remote prompt (>) with the appropriate parameter, and then press the ENTER key. The TDR6 performs the required function and displays the prompt (>) when it is ready to accept another command.

The following syntax is used: <command>

where

- `<command>` consists of its mnemonic and the instruction; ensure that the command is typed correctly and includes spaces, periods, or underscore (_) characters as appropriate
- There must be one space between the command and the parameter. A space is typed by pressing the Space Bar key.
- `<parameter>` is the value pertaining to the command. Parameters can be numeric or alphanumeric. No spaces should be typed after the parameter; doing so will result in an error.

For example:

- To set the remote port baud rate to 1200 bps, issue the command `MC RS232 BAUD 1200` and press Enter. In this example:
  - The command mnemonic is `MC RS232` followed by a space
  - The command instruction is `BAUD` followed by a space
  - The parameter is `1200`
- To query the remote port baud rate, issue the command `MC BAUD` and press Enter. The TDR6 responds by displaying the baud rate on the remote unit.

The audio decoder (AD), demodulator (DMD), and user data (UD) commands contain additional command designators which enable you to configure a specific port. The command designators, shown on the TDR6 rear panel, are:

- ADA through ADF – audio ports A through F
- DMD.A through DMD.D – demodulator ports A through D
- UDA and UDB – user data ports A and B
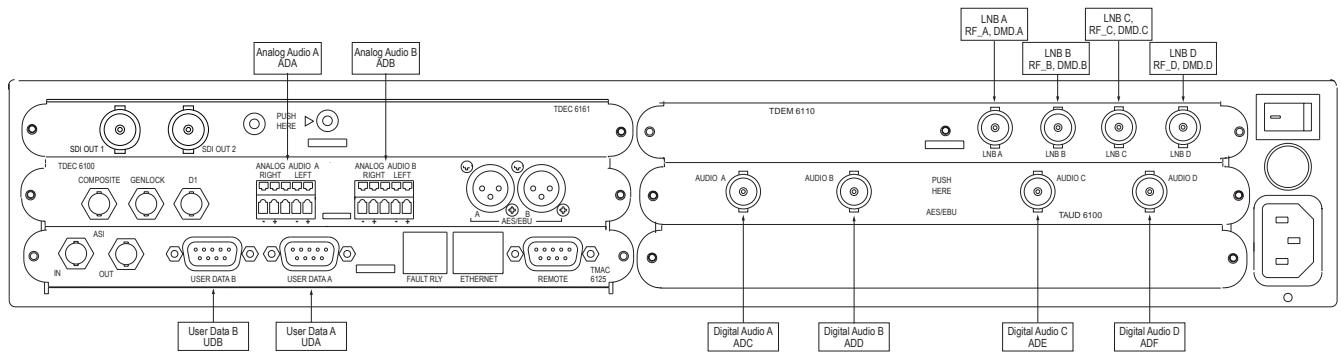
TDR6 HD/SD Back Panel with Remote Designators

For example:

All *audio decoder* commands begin with the command mnemonic AD, and they contain the *<port>* designators, A through F, which allow you to select which audio port to configure or monitor. All audio decoder commands are typed in the following format: `<AD><port> <instruction> <parameter>`

- To set audio channel A to PID to 12, issue the command `ADA PID 12` typed as follows:

    ADA <space> PID <space> 12

- To set both user data ports to automatically select the lowest incoming PID in the data stream, issue the following two commands:
    - UDA AUTO On
    - UDB AUTO On

DMD designators are typed within the command and are separated by periods (.), for example:

<command mnemonic>**.**<port> <command instruction>

For example, to set the demodulator FEC code rate to 1/2 for LNB input A, type DMD**.**A CR 1/2

To verify that the TDR6 set the parameter correctly, enter the appropriate query command.

Typing Remote Commands

Remote commands are not case sensitive. Commands may be entered in lower case, upper case, or a combination of both.

Error Messages   If the TDR6 is not able to execute a command, an error message will be returned, indicating the command was not completed. TDR6 error messages, along with the action required to resolve the error, are explained in the following table.

Error Messages		
Message	**Explanation**	**Action Required**
Error	The TDR6 was unable to execute the requested command. This is a summary error, which may indicate a hardware failure or configuration abnormality.	Repeat the requested command. If the command still results in an error message, check the configuration of the unit and repeat the command. If an error results, reset the unit and attempt the command again. If you are unable to execute the command, contact Customer Service.
Format Error	The command syntax was entered incorrectly.	Re-enter the command using the proper syntax and format.
Parameter Error	The TDR6 does not recognize the parameter. A numerical parameter may be out of range, or an ASCII character string may not match any of the available parameters for the command.	Re-enter the command using the correct parameter.
Not Supported	The requested command does not match any valid TDR6 command.	Review the lists of commands to ensure that you entered a valid command.

In addition to the actions listed in the error messages table, you can also enter the following types of commands to receive additional information when errors are encountered or additional information is needed.

Informational Remote Commands	**Response**
<mnemonic> For example: ADA	Displays system information associated with that command.
<mnemonic> <instruction> ? For example: MC RS232 BAUD ?	Lists information available for that particular command, including all valid parameters

Command Descriptions   The standard TDR6 remote commands are listed in the following table, which provides the following information:

- Remote command mnemonic
- Parameter values or command response values
- Factory DVB-compliant default value
- Description of the command, including parameter definitions and the front panel command equivalent

NOTE

Commands used to set a parameter may also be used to query the current command. Use the command mnemonic without a parameter and the TDR6 will return the current parameter setting.

The specific commands available depend on the option modules installed in your TDR6.

TDR6 Remote Command Listing			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
AD*x*	where *x* = A, B, C, D, E, or F	—	The TDR6 can be configured with up to six separate audio channels based on the installed option cards. The ports are identified based on the following: ■ If only a TDEC-6100 option module is installed, audio ports A and B can be configured. ■ If only a TAUD-6100 option module is installed, audio ports A to D can be configured. ■ If both option modules are installed, audio ports A, B, C, and D correspond to the audio ports located on the TAUD-6100 board, while audio ports E and F correspond to the audio ports located on the TDEC-6100 option module. For the remote command AD*x*, *x* = A, B, C, D, E, or F, and designates the audio output that is the object of the command, as described above. Commands for all audio channels are the same. When AD*x* is entered, the TDR6 returns the following audio information for the designated channel: auto select, PID, source, channel mode, volume, preferred language, sync, delay, and rate. Front panel equivalent: None
AD*x* AUTO	On, Off	On	Sets how PIDs are selected for the specified audio output: ■ On: TDR6 selects the lowest incoming PID ■ Off: Operator must enter the PID manually Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Auto Select
AD*x* CHANNELMODE	Left, Right, Stereo	Stereo	Sets the mode for the specified audio output: ■ Left: Selects the audio stream from the left channel and supplies that stream to both the audio left and audio right outputs ■ Right: Selects the audio stream from the right channel and supplies that stream to both the audio right and audio left outputs ■ Stereo: Supplies both mono streams to the audio left and right outputs exactly as sent by the encoder Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Channel Mode
AD*x* DELAY	-1000 to +1000 milliseconds	0	Sets the compressed audio bit stream buffer delay, which controls the amount of time delay between the audio and video. Delay is primarily provided for interoperability with other manufacturers' equipment. It is not normally necessary to use a non-zero delay value. Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Delay
AD*x* LANG	English, Russian, Spanish, French, German, Dutch, Italian, Portuguese, Korean, Japanese, Chinese, Arabic, Malayalam	English	Selects the language for the specified audio output from the languages available in the selected service. Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Preferred
AD*x* PID	<available PIDs> or OFF	ADA—36 ADB—37 ADC—38 ADD—39 ADE—36 ADF—37	Selects a specific PID from those currently available. When no audio is present, the system returns the message *no audio present*. To query all available audio PIDs, enter the command AD*x* PID ? Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>PID
AD*x* RATE	0 to 640	—	Query-only; displays the audio data rate Front panel equivalent: None

TDR6 Remote Command Listing (continued)

Mnemonics	Parameters/ Response Values	DVB Defaults	Description
AD*x* SAMPLE RATE	n/a, 0, 32, 44.1, 48	—	Query-only; displays the audio sample rate. Only available in MPEG audio mode.
AD*x* SOURCE	MPEG-2, ATSC	MPEG2	Query-only; displays the source for the specified audio output. Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Source
AD*x* VOL	0 - 18 dBu	18 dBu	Sets the audio volume. The TDR6 cannot increase or amplify the incoming audio level. ■ 18 dBu: output value is equal to that of the input signal level ■ < 18 dBu: TDR6 attenuates the input signal level Front panel equivalent: Details>Audio>Slot_*x*>Audio *x*>Volume (analog audio only)
BISS		—	When BISS is entered, the decoder returns the following information: ■ Status: *<scrambling status>* ■ Mode: *<selected BISS mode>* ■ 1Key: <************> ■ EKey: <****************> ■ EID: <**************>
BISS 1KEY *<value>*	where *<value>* is a 12 character hexadecimal value, ***that does not begin with 0x*** If less than 12 characters are entered, the TDR6 will not set the command. If more than 12 characters are entered, the TDR6 truncates the value to the first 12 characters entered.	—	Sets the key value for BISS 1 mode. The 1 key value is also referred to as the *clear session word*. ***Important Considerations when entering BISS 1KEY:*** ■ This command must be set before BISS Mode1 is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* ■ The value cannot be displayed once it is entered. Instead, the TDR6 will display 12 asterisks *.
BISS EID *<value>*	where *<value>* is a 14 character hexadecimal value, ***that does not begin with 0x*** If less than 14 characters are entered, the TDR6 will not set the command. If more than 14 characters are entered, the TDR6 truncates the value to the first 14 characters entered.	—	Sets the identification value for BISS E mode. The E ID value is also referred to as the *Injected ID*. ***Important Considerations when entering BISS EID:*** ■ This command must be set before BISS ModeE is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* ■ The value cannot be displayed once it is entered. Instead, the TDR6 will display 14 asterisks *.
BISS EKEY *<value>*	where *<value>* is a 16 character hexadecimal value, ***that does not begin with 0x*** If less than 16 characters are entered, the TDR6 will not set the command. If more than 16 characters are entered, the TDR6 truncates the value to the first 16 characters entered.	—	Sets the key value for BISS E mode. The E key value is also referred to as the *encrypted session word*. ***Important Considerations when entering BISS EKEY:*** ■ This command must be set before BISS ModeE is set. ■ This command may not be entered/changed more than 10 times within a five minute time period. ■ When re-entering/changing this command, there must be at least a 10 second time delay between entries. ■ The value cannot begin with the hex values *0x* ■ The value cannot be displayed once it is entered. Instead, the TDR6 will display 16 asterisks *.

	TDR6 Remote Command Listing (continued)		
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
BISS MODE	none, mode1, modee	none	Sets the BISS mode used to descramble the incoming transport stream. ***Note***: Before setting this command to mode1 or modeE, the appropriate KEY and ID values must first be entered. ***Note***: There may be a slight delay in picture when setting or changing BISS modes. This is due to the routing of the signal to the descrambling chip. ***Note***: To ensure proper BISS operations, ensure that PGCA is set to Off.
BISS STATUS	scrambled, not_scrambled	—	Query-only; displays the state of the incoming transport stream: ■ Scrambled: the incoming transport stream is scrambled ■ Not_scrambled: the incoming transport stream is not scrambled
DC	—	—	When DC is entered, the TDR6 returns the following decompressor information: PSI enable, program number, clock recover, PCR PID, lock transport, PCR filter, and peak PCR jitter. Front panel equivalent: None
DC AUTOSEL	On, Off	On	Sets how PIDs are selected: ■ On: TDR6 selects the lowest incoming program ■ Off: Operator must enter the program manually Front panel equivalent: Details>Service>Auto Select
DC FILTER	Normal, ATM	Normal	Sets the PCR (program clock reference) filter for normal operations or operations over an ATM network. ■ Normal: set for normal operations ■ ATM: set for operations over an ATM network Front panel equivalent: Details>input>Config>Filter>PCR Filter
DC INPUT	ASI, RF_A, RF_B, RF_C, RF_D	ASI	Selects input source. ■ ASI: selects an external demodulator as input source ■ RF_A: selects RF input as the transport stream source and LNB 1 as active port ■ RF_B: selects RF input as the transport stream source and LNB 2 as active port ■ RF_C: selects RF input as the transport stream source and LNB 3 as active port ■ RF_D: selects RF input as the transport stream source and LNB 4 as active port Front panel equivalent: Details>Input>Config>Select>Input
DC JITTER	0 to 3500000 ns	—	Query-only; displays the difference, or jitter, between the STC and PCR clocks. Front panel equivalent: Details>Input>Status>Peak Jitter
DC LOCK TRANSPORT	Locked, Unlocked	—	Query-only; displays lock status of transport stream Front panel equivalent: Details>Input>Status>Transport
DC PCR PID	—	—	Query-only; displays the program clock reference PID, which is automatically selected by the TDR6. Front panel equivalent: None
DC PROG	<number>	1	Selects or displays the service. When queried, the response contains the number, the service number and the name, if any. For example: `DC PROG 1,Service 1,Unnamed` When no services are present, the system returns the message *no services available*. Front panel equivalent: Details>Service

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
DMD.*x*	Where *x* is A, B, C, or D and designates the demodulator to be configured or queried.	—	Combined with additional mnemonics, specifies the demodulator that is the object of the command. For example, if RF output B is currently active, the DMD.B DMLOCK command displays the current lock status of demodulator B. By itself, queries all parameters of specified demodulator.When DMD.*x* is entered, the TDR6 returns the following information for the designated channel: Eb/No, locked status for the decoder and demodulator, offset, modulation type, LO frequency, RF frequency, data rate, symbol rate, code rate, LNB power, and rolloff setting. Commands for all demodulator ports are the same. Front panel equivalent: None
DMD.*x* BER	—	—	Query-only; displays the bit error rate; this value represents the number of errors detected in the signal after error correction is applied. This rate should be a zero for correct performance.
DMD.*x* CR	1/2, 2/3, 3/4, 5/6, 7/8, 8/9	5/6	Sets the Viterbi code rate for the designated demodulator. Front panel equivalent: Details>Input>Config>Demod>RF>Code Rate
DMD.*x* DCLOCK	locked, unlocked	—	Query-only; displays the locked status of the **_decoder_** to the incoming signal. Front panel equivalent: Details>Input Status>Decoder
DMD.*x* DMLOCK	locked, unlocked	—	Query-only; displays the locked status of the **_demodulator_** to the incoming signal. Front panel equivalent: Details>Input>Status>Demod
DMD.*x* DR	1000000 to 100000000 bps	8448000	Sets the value for the incoming demodulated data rate for the designated demodulator. Front panel equivalent: Details>Input>Config>Demod>RF>Data Rate
DMD.*x* EBNO	-99 to 99 dB	—	Query-only; displays the energy per bit over the noise ratio of the signal after Viterbi decoding and before Reed-Solomon decoding for the designated demodulator. Front panel equivalent: Details>Input>Status>Eb/No
DMD.*x* LNB	OFF, 13V, 18V	Off	Sets the output DC voltage to power the antenna's low noise block amp and defines polarization for the designated demodulator. Front panel equivalent: Details>Input>Config>Demod>RF>LNB Power
DMD.*x* LO	0 to 15000 MHz	10000	Sets an internal representation of the local oscillator frequency of the external down converter for the designated demodulator. Front panel equivalent: Details>Input>Config>Demod>RF>LO Frequency
DMD.*x* MOD	QPSK, 8PSK, 16QAM	QPSK	Sets the modulation type for the decoder. Front panel equivalent: Details>Input>Config>Demod>RF>Modulation
DMD.*x* OFFSET	—	—	Query-only; displays the difference between the frequency set by the user and the frequency actually locked onto. Front panel equivalent: None
DMD.*x* RAWBER	—	—	Query-only; displays the raw bit error rate; this rate is the error rate of the signal as it is received from the satellite, before error correction is applied.

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
DMD.*x* RF	0 to 15000 MHz	11210	Sets an internal representation of the frequency of the modulated signal before external down conversion. This will generally be the frequency of the signal coming from the satellite. This number is used to calculate the incoming frequency. The incoming frequency is the difference between the local oscillator frequency and the radio frequency. Front panel equivalent: Details>Input>Config>Demod>RF>RF Frequency
DMD.*x* ROLLOFF	35RCRO, 25RCRO	35RCRO	Sets the percentage, 35% or 25%, of excess bandwidth available for other data. **Note**: This parameter is only valid when DMD.x MOD is set to either 8PSK or 16QAM. Front panel equivalent: Details>Input>Config>Demod>RF>Rolloff
DMD.*x* SR	1000000 to 37500000 sps	—	Sets the value for the incoming modulated signal symbol rate (in sps). Front panel equivalent: Details>Input>Config>Demod>RF>Sym Rate
DMD.*x* TUNE	950 to 2150 MHz	1210	Sets the carrier frequency of the incoming L-band modulated signal. This can be set explicitly or can be calculated as the difference between the down converter's local oscillator frequency and the radio frequency. Front panel equivalent: None
FAULTLOGCLEAR	—	—	Clears the fault log. Front panel Equivalent: Faults>Clear
FC	—	—	Query-only; displays current faults. Front panel Equivalent: Faults>Current
FH	—	—	Query-only; displays the fault history. All faults in the fault history log are date and time stamped. Front panel Equivalent: Faults>History
HDVD	—	—	When HDVD is entered, the TDR6 returns the following information for HD video: format, frame rate, PID, and delay setting Front panel equivalent: None
HDVD CHROMA	n/a, 4_2_0, 4_2_2, 4_4_4	—	Query-only; displays the video chroma format for the *HD* input transport stream.
HDVD DELAY	-1000 to 1000	0	Allows you to set the delay between the time the high-definition video data is received and the time the video data is sent to the video output port to compensate for the clocking of the video encoder. To align the audio with the video, enter 0 for no delay. Front panel equivalent: Details>Video>Slot_*x*>HD Vid>Delay
HDVD FORMAT	1080i, 720p	720p	Sets the high-definition video format, auto-selected by the TDR6. Supported formats are 1080I and 720P. Front panel equivalent: Details>Video>Slot_*x*>HD Vid>Format
HDVD FRATE	25, 29.97, 30, 59.94, 60	59.94	Sets the frame rate for high-definition video. Front panel equivalent: Details>Video>Slot_*x*>HD Vid>Frame Rate
HDVD PID	<available PIDs> or OFF	33	Selects a specific high-definition video PID from those currently available. When no video is present, the system returns the message *no video present*. To query all available HD video PIDs, enter the command HDVD*x* PID ? Front panel equivalent: Details>Video>Slot_*x*>HD Vid>PID

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
MC	—	—	When MC is entered, the TDR6 returns the following master controller information: ■ Ethernet: IP address, IP mask, IP gateway, and MAC ■ RS232: baud rate, data hits, parity, stop bits, soft flow control and hard flow control information Front panel equivalent: None
MC ACCESS CODE	1000 to 9999	7384	Sets the password required to unlock the front panel. Front panel equivalent: None
MC ACCESS FP	RO, RW	RW	Sets the state of the front panel: ■ RO: locks the front panel ■ RW: unlocks the front panel When queried, the system displays either: ■ Locked: the front panel is locked and the TDR6 cannot be configured from the front panel, however, all status and configuration parameters can be viewed. ■ Unlocked: the front panel is unlocked and the TDR6 can be fully configured, monitored, and controlled using the front panel. **Note**: when the front panel is locked using a remote command, no message signifying this lock status is displayed on the front panel. When an operator attempts a configuration change from the front panel the TDR6 displays the message *front panel locked*. For additional information on locking or unlocking the front panel, refer to the front panel chapter. Front panel equivalent: Control>FP_Lock>State
MC ACCESS UNLOCK	<password>	—	Unlocks the front panel. You must enter either the password set using the `MC ACCESS CODE` command or, if it has not been changed, the default password 7384. For more information on locking or unlocking the front panel, refer to the front panel chapter. Front panel equivalent: Control>FP Lock>State
MC CLOCK DATE	mm/dd/yyyy	—	Sets the TDR6 real-time date. To set, enter the date in the format: *mm/dd/yyyy* Front panel equivalent: Control>Clock>Date
MC CLOCK TIME	hh:mm:ss	—	Sets the TDR6 real-time clock. To set, enter the current time in the format: *hh:mm:ss* The hours are in a 24–hour format and must be set from 0 to 23, where 0 is midnight and 23 is 11 PM. For example, for 8 AM you would set 8, and for 8 PM you would set 20. Both minutes and seconds can be set from 0 to 59. Front panel equivalent: Control>Clock>Time
MC CONFIG LIST	—	—	Query-only; displays the currently active configuration and a list of both factory- and user-defined configurations. Front panel equivalent: None
MC CONFIG RESTORE <*string*>	where <*string*> = user1, user2, or user3	—	Resets TDR6 with the user-defined configuration specified in <*string*>. For more information on configurations, refer to the configuration chapter. Front panel equivalent: Config>User>Restore
MC CONFIG SAVE <*string*>	where <*string*> = user1, user2, or user3	—	Saves current configuration with the user label specified in <*string*>. If no string is specified, the current configuration is saved as the power-up configuration. For more information on configurations, refer to the configuration chapter. Front panel equivalent: Config>User>Save

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
MC DEFAULT RESTORE <string>	where <string> = DVB, Default1, Default2, and Default3	—	Resets the TDR6 with the specified factory-default operating configuration. For more information on configurations, refer to the configuration chapter. Front panel equivalent: Config>Default>Restore
MC ETHERNET IP ADDRESS	<x.x.x.x> where each x represents a decimal number from 0 to 255	—	Sets the ethernet IP address for the TDR6. Example: 192.200.9.201 Front panel equivalent: Control>Network>Address
MC ETHERNET IP GATEWAY	<x.x.x.x> where each x represents a decimal number from 0 to 255	0.0.0.0	Sets the IP gateway address. Front panel equivalent: Control>Network>Gateway
MC ETHERNET IP MAC	Format: <xx:xx:xx:xx:xx:xx> where xx is a hexadecimal number from 0 to f.	—	Sets the Ethernet hardware address. For example: 00:e0:74:00:02:cb
MC ETHERNET IP MASK	<x.x.x.x> where each x represents a decimal number from 0 to 255	255.255.255.0	Sets the IP address mask (IP subnet mask). Front panel equivalent: Control>Network>Mask
MC HW OPTS	—	—	Query-only; displays the optional hardware installed on the controller card. Front panel equivalent: None
MC HW TYPE	—	—	Query-only; displays the type of decoder hardware. Front panel equivalent: None
MC RS232 BAUD	1200, 2400, 4800, 9600, 19200, 38400	38400	Sets the baud rate for the remote port. Front panel equivalent: Control>EIA-232>Baud
MC RS232 DATA	7, 8	8	Sets the data bits for the remote port. Front panel equivalent: Control>EIA-232>Data Bits
MC RS232 HARDFLOW	On, Off	On	■ On: sets data flow to be controlled by hardware ■ Off: permits data flow to be controlled by hardware Front panel equivalent: Control>EIA-232>Hard Flow
MC RS232 PARITY	None, Odd, Even	None	Sets the parity for the remote port. Front panel equivalent: Control>EIA-232>Parity
MC RS232 SOFTFLOW	On, Off	Off	■ On: sets data flow to be controlled by software ■ Off: permits data flow to be controlled by software Front panel equivalent: Control>EIA-232>Soft Flow
MC RS232 STOP	1, 2	1	Sets the stop bits for the remote port. Front panel equivalent: Control>EIA-232>Stop Bits
MC SW	—	—	Query-only; displays the installed software version. Front panel equivalent: Version
PGCA	—	—	When PGCA is entered, the TDR6 returns the following conditional access information: mode, status, authorization, and time-out Front panel equivalent: None
PGCA AUTHORIZATION	Yes, No, N/A	—	Query-only; displays whether the originator of the service has authorized your TDR6 to receive the selected service. Front panel equivalent: Details>PGCA>Authorization
PGCA MODE	Auto	Auto	Sets the TDR6 to automatically receive authorized PGCA-protected signals. Front panel equivalent: None
PGCA STATUS	In_the_Clear, PGCA_Enabled	—	Query-only; displays whether or not a signal is PGCA protected. Front panel equivalent: Details>PGCA>Status

	TDR6 Remote Command Listing (continued)		
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
PGCA TIMEOUT	Time in seconds	—	Query-only; displays the amount of time that the service originator allows the TDR6 to remain authorized to receive the selected service in the event that the TDR6 stops receiving periodic service authorization messages. Front panel equivalent: Details>PGCA>Timeout on loss
UD*x* where *x* = A or B	—	—	Combined with additional mnemonics, specifies the user data port that is the object of the command. When UDx is entered, the TDR6 returns the following user data information: PID, auto select, source, interface type, handshake, config mode, baud rate, data bits, parity, and stop bit settings. Front panel equivalent: None
UD*x* AUTO	On, Off	On	Sets how PIDs are selected. ■ On: TDR6 selects the lowest incoming PID ■ Off: Operator must enter the PID manually using the UD*x* PID command Front panel equivalent: None
UD*x* BAUD_ASYNC	1200, 2400, 4800, 9600, 19200, 38400	38400	Query-only; displays the baud rate for the specified asynchronous user data port. Front panel equivalent: Details>Data>Data A/B>Baud (when data is asynchronous)
UD*x* BAUD_SYNC	0 TO 4096000	38400	Query-only; displays the baud rate for the specified synchronous user data port. Front panel equivalent: Details>Data>Data A/B>Baud (when data is synchronous)
UD*x* DATA	7, 8	8	Query-only; displays the data bits for the specified asynchronous user data port. Front panel equivalent: Details>Data>Data A/B>Data Bits (when data is asynchronous)
UD*x* HANDSHAKE	On, Off	Off	Sets the handshaking parameter for the specified user data port: ■ On: Enables handshaking for the specified user data port ■ Off: Disables handshaking for the specified user data port Front panel equivalent: None
UD*x* INTERFACE	EIA-232; EIA-422	EIA-232	Sets the hardware interface for the specified user data port to be either EIA-232 or EIA-422 compliant. Front panel equivalent: Details>Data>Data A/B>Interface
UD*x* PARITY	None, Odd, Even	None	Sets the parity for the specified asynchronous user data port. Front panel equivalent: Details>Data>Data A/B>Parity (when data is asynchronous)
UD*x* PID	<available PIDs> or Off	0x0030	Sets the PID for the specified user data port. When no user data is present, the system returns the message *no data present*. To query all available user data PIDs, enter the command UD*x* PID ? Front panel equivalent: Details>Data>Data A/B>PID
UD*x* SOURCE	—	—	Query-only; displays the source (synchronous or asynchronous), and baud rate of the user data at the input to the encoder. For asynchronous user data, also displays the number of data bits and the number of stop bits. When no user data is present, the system returns the message *no data*. Front panel equivalent: Details>Data>Data A/B>Source
UD*x* STOP	1, 2	1	Sets the stop bits for the specified asynchronous user data port. Front panel equivalent: Details>Data>Data A/B>Stop Bits (when data is asynchronous)

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
VBI	—	—	When VBI is entered, the decoder returns the following information: ■ PID: *PID #* ■ Mode: *<on or off>* ■ lines: *<active lines>* ■ VBI format control: *<auto or manual>* ■ VBI format: *<detected format>* ■ TiernanCC detected: *<yes or no>* ■ Detected VBI Format: *<type of expanded windows detected>*
VBI CONTROL	auto, manual	manual	Setting determines if the decoder will automatically detect, decode, and include the VBI data in the output stream, or if the user will manually set all parameters. ■ Auto – the decoder automatically determines the type of incoming VBI data, decodes it and includes it in the output stream ■ Manual – enables you to manually set the VBI format to be decoded and included in the video output stream.
VBI FORMAT	off, TIERNANCC, lines16, lines32	off	When VBI Control is set to Auto, this parameter is query-only; the decoder automatically detects and processes the incoming VBI data. When VBI Control is set to Manual, this parameter is used to set the type of VBI format to be decoded and included in the video output stream. ■ Off – no VBI information will be included in the video output stream ***Note***: VBI Control must be set to manual for this parameter to be set to off. ■ TiernanCC – sets the VBI format to Tiernan proprietary closed captions ■ Lines16 – sets the VBI format to expanded windows, 16 lines ■ Lines32 – sets the VBI format to expanded windows, 32 lines
VD	—	—	When VD is entered, the TDR6 returns the following standard definition video information: PID, mode, PAL submode, setup 7.5 IRE, auto, vertical and horizontal offset, and delay setting. Front panel equivalent: None
VD AUTO	On, Off	On	Sets how PIDs are selected. ■ On: TDR6 selects the lowest incoming video PID ■ Off: Operator must enter the video PID manually Front panel equivalent: None
VD CHROMA	n/a, 4_2_0, 4_2_2, 4_4_4	—	Query-only; displays the video chroma format for the **SD** input transport stream.
VD CLOSED_CAP	on, off	off	Providing that line 21 closed captioning is available in the selected service, VD CLOSED CAP allows you to determine whether line 21 will be included in the video output stream. If set to On – line 21 data will be included; Off – line 21 will not be included. Closed Captioning is only available when VD MODE is set to NTSC. Front panel equivalent: Details>Video>Slot_*x*>Std Vid>Tiernan Closed Cap
VD DELAY	-1000 to 1000	0	Allows you to set the delay between the time the standard-definition video data is received and the time the video data is sent to the video output port to compensate for the clocking of the video encoder. To align the audio with the video, enter 0 for no delay. Front panel equivalent: Details>Video>Slot_*x*>Std Vid>Delay

TDR6 Remote Command Listing (continued)			
Mnemonics	**Parameters/ Response Values**	**DVB Defaults**	**Description**
VD MODE	PAL, NTSC, AUTO	PAL	Sets the standard-definition video mode. Front panel equivalent: Details>Video>Slot_*x*>Std Vid>Mode
VD PID	<available PIDs> or Off	—	Selects the standard-definition video PID you want. When no video is present, the system returns the message *no video present*. To query all available video PIDs, enter the command VD*x* PID ? Front panel equivalent: Details>Video>Slot_*x*>Std Vid>PID
VD SETUP	Off, On, Auto	Auto	Sets the 7.5 IRE pedestal-standard for NTSC. Front panel equivalent: Details>Video>Slot_*x*>Std Vid>Setup 7.5 IRE
VD SUBMODE	B, D, G, H, I	I	Sets the PAL submode for standard-definition video. Front panel equivalent: Details>Video>Slot_*x*>Std Vid>PAL Submode

Configuring the TDR6

5

This chapter provides information on configuring the TDR6 for initial operation including:

- Quick start configuration
  - Setting the DVB defaults
  - Selecting a service
  - Setting the time and date
- Detailed TDR5 configuration
  - High-level configuration procedure
  - Configuring the demodulator

Configuration changes may be made using the front panel or remote commands.

All TDR6 configuration changes issued from the front panel are automatically saved to nonvolatile memory.

> **NOTE**
> Unlike front panel operations, TDR6 parameter changes made from a remote unit are not automatically saved to nonvolatile memory. If configuration changes are made to a TDR6 from a remote unit, issue the command `MC CONFIG SAVE <string>` to save the configuration to nonvolatile memory.

Quick Start Configuration

To set the TDR6 to the default configuration and immediately begin operations, follow these steps:

1. Set the TDR6 to the appropriate default configuration.
2. Select a service.
3. Set the local date and time.

In the TDR6, both the video decoder and the audio decoder are fully auto-detecting, which means that the TDR6 automatically sets the video and audio parameters based on the incoming service signal.

Setting the **Default Configuration**

To initialize the TDR6 to the DVB-compliant default configuration using the front panel follow these steps:

1. From the main menu, select Config.

> DVT Receiver/Decoder
>
> Config   Details   Faults ---->

2. The Configuration menu displays. Select Default.

> Configuration Menu
> Default   User

The Default Configuration menu displays. The configuration option that appears on the LCD, in this example Default1, is the current TDR6 configuration.

> Default Config. Menu
> Config =   Default1 ---->

If the LCD initially displays `Config = DVB`, the TDR6 was initialized to the default DVB-compliant configuration. ***However***, some or all of the parameters may have been manually changed since the unit was initialized. To ensure that all of the TDR6 parameters are set to the default DVB configuration, continue with the next step.

3. Scroll to and select the `DVB` parameter. The option begins to flash.

> Default Configuration Menu
> Config =   DVB ---->

4. Press the Enter button. The TDR6 reconfigures the system to the DVB defaults.

> Initializing . . .

5. When the DVT Receiver/Decoder main menu displays, the TDR6 is set to the default DVB configuration.

To initialize the TDR6 to the DVB-compliant configuration using a remote unit:

1. Issue the command `MC DEFAULT RESTORE DVB`.

2. Ensure that the baud rate setting for your remote device communications package is set to 38400 bps.

> **NOTE**
>
> If the remote unit is set to communicate with the TDR6 at a baud rate other than 38400 bps, the remote unit will not be able to communicate with the TDR6 after the defaults have been set. To resolve this issue, the equivalent parameter in the software settings of the remote unit must be changed to 38400 bps.
>
> ***However***, the remote unit software settings must not be changed before issuing the MC Default Restore command to the TDR6, as the remote unit will not be able to communicate with the TDR6.

Selecting a Service

The TDR6 automatically selects the first service in the transport stream. You may need to select another service. To select a service using the front panel:

1. From the Details menu select Service>Number. The LCD displays the current service.

2. Select the service, which begins to flash.

3. Scroll through the list of services until the required service is displayed.

4. Press the Enter button.

To select a service using the remote unit issue the command `DC PROG #`, where # is the number of the required service.

Setting Local Date and Time

To set the date and time using the front panel:

1. From the Config menu select Control>Clock>Date.
2. Use the keypad to type in the correct date in *mm.dd.yyyy* format and press Enter.
3. Press the Next button. The LCD displays the Time menu.
4. Use the keypad to type in the correct time in *hh.mm.ss* format, separating each category with a period, and press Enter

To set the date and time using a remote device:

1. To set the date, issue the command `MC CLOCK DATE <mm/dd/yyyy>` where `<mm/dd/yyyy>` is the current month, day, and year.
2. To set the time, issue the command `MC CLOCK TIME <hh:mm:ss>` where `<hh:mm:ss>` is the current time.

Detailed TDR6 Configuration

TDR6 Detailed Configuration Procedure

The following steps are a high-level procedure you should use to make any required configuration changes.

1. Make a list of your operational requirements.
2. Determine which TDR6 default parameters must be changed by comparing your requirements to the corresponding DVB-compliant or other default parameter settings.
3. Write down the parameter values required to meet your operating requirements and the corresponding front panel or remote commands required to change those parameters.
4. Configure the TDR6 to the selected default configuration.
5. Configure the TDR6 with any new parameters.
6. Save the configuration.
7. Ensure that the encoder is correctly configured to operate with the TDR6 parameter settings.

Demodulator Configuration

If the TDR6 includes one or more demodulators, you must configure the TDR6 before beginning operations.

This chapter contains basic demodulator configuration information. For additional technical information regarding demodulator configuration, refer to the QPSK demodulator appendix.

Required Information

Before you begin to configure a demodulator, you must have the following information:

- Satellite downlink frequency (RF Freq)
- LO frequency (LO Freq)
- Transport data rate or transmission symbol rate (Data Rate)
- Viterbi code rate (Code Rate)
- LNB voltage (LNB Power) required to polarize your LNB to the downlink signal

Configuring the L-Band Carrier Frequency

The LNB downconverter outputs a DVB-compliant, modulated L-band carrier at an IF frequency which is input to the demodulator. For proper operation, the input L-Band carrier frequency must be equal to RF Ð LO where:

- RF is the carrier frequency at the input to the LNB
- LO is the local oscillator frequency within the LNB

Note that it is not the absolute values of RF and LO that are important, just the difference.

You must configure both the RF and LO parameters. If the entered RF or LO parameters are incorrect, the actual carrier frequency will be different from the programed carrier frequency.

To determine the difference, if any, query the Offset parameter.

While the TDR6 is acquiring carrier lock, the Offset parameter is not valid. Once lock has been achieved, the offset parameter provides a valid measure of the difference between the actual receiver carrier and the calculated receiver carrier.

To achieve carrier lock, the Offset must be less than 2 MHz. For optimum performance, the Offset parameter should be as close to zero as possible.

To configure the L-band carrier frequency:

1. Check the Offset parameter.
2. Adjust the RF and LO parameters if necessary.

To query the offset using the front panel:

Select Details>Input>Status>Offset.

To adjust the RF and LO parameters using the front panel:

1. When the decoder is locked onto the receive carrier, query the offset parameter using the front panel Details>Input>Status>Offset menus or the remote command `DMD.x OFFSET`.

   The Offset parameter must be less than 2 MHz to achieve carrier lock. For optimum performance, it should be zero.

2. Verify that you have entered the correct LO value. Refer to the LNB documentation.

3. Adjust the RF parameter, if necessary.

   a. Subtract the Offset parameter from the current RF parameter (RF Ð LO).

   b. Enter the result as the new RF parameter using the front panel Details>Input>Config>Demod>RF_x>RF Freq menu or the remote command `DMD.x RF <new value>`.

Example: Configuring the Demodulator

This is an example of configuring a TDR6 with a TDEM-6110 option module installed. Use this example as a guide, substituting your site-specific parameters.

Step 1: In this example, assume that your operations require the following parameters:

- Input: RF
- Modulation: QPSK
- RF Freq: 11.774 GHz
- LO Freq: 10.750 GHz
- Data Rate: 8.448 Mbps
- Code Rate: 3/4
- LNB Power: 13 V

Step 2: By comparing your system requirements to the DVB-compliant settings, you determine the following parameters must be changed:

- Input
- Modulation
- RF Freq
- LO Freq
- Code Rate
- LNB Power

Step 3: To change these parameters the following front panel or remote commands can be used.

Parameter	Front Panel Menu	Remote Command
Input	Details>Input>Config>Select>Input = RF_A	DC INPUT RF_A
Modulation	Details>Input>Config>Demod>RF_A> Modulation = QPSK	DMD.A MOD QPSK
RF Freq	Details>Input>Config>Demod>RF_A> RF Freq = 11774	DMD.A RF 11774
LO Freq	Details>Input>Config>Demod>RF_A> Lo Freq = 10750	DMD.A LO 10750
Code Rate	Details>Input>Config>Demod>RF_A> Code Rate = 3/4	DMD.A CR 5/6
LNB Power	Details>Input>Config>Demod>RF_A> LNB Power = 13V	DMD.A LNB 13V

Step 4: This example assumes that the TDR6 has been previously initialized to the DVB default settings.

Step 5: Assuming the TDR6 is set to the DVB defaults settings, the new parameters must be entered.

1. Set the TRD6 input to RF using either the front panel `Details>Input>Config>Select>Input>RF A` option or the remote command `DC INPUT RF_A`.

2. Se the Modulation type using either the front panel `Details>Input>Config>Demod>RF_A>Modulation QPSK` or the remote command `DMD.A MOD QPSK`.

3. Set the RF frequency using either the front panel `Details>Input>Config>Demod>RF_A>RF Freq 11774` or the remote command `DMD.A RF 11774`.

4. Set the LO frequency using either the front panel `Details>Input>Config>Demod>RF_A>LO Freq 10750` or the remote command `DMD.A LO 10750`.

5. Set the code rate using either the front panel `Details>Input>Config>Demod>RF_A>Code Rate 3/4` or the remote command `DMD.A CR 5/6`.

6. Set the LNB voltage using either the front panel `Details>Input>Config>Demod>RF_A>LNB Power 13V` or the remote command `DMD.A LNB 13V`.

Step 6: Save the configuration.

Step 7: Ensure that the decoder is correctly configured to operate. As part of this process verify that the parameters you just entered are correct. To verify your entries issue the remote command `DMD.A` or review all parameters via the front panel.

Troubleshooting

6

This chapter provides information on troubleshooting, including:

- Fault reporting and monitoring
- Initialization self-test function
- Operational problems
- Troubleshooting the demodulators

Fault Reporting and Monitoring

Front Panel LEDs

The three LED indicators located on the TDR6 front panel are described in the following table.

Status LEDs		
LED	**State**	**Indicates**
Power	Illuminated green	TDR6 is powered on
	Not illuminated	TDR6 has no power
Fault	Illuminated orange	One or more faults currently exist
	Not illuminated	No faults currently exist
Status	Not illuminated	The demodulator, decoder, and transport stream are *not all* locked or other alarm conditions may be present
	Illuminated green	The above conditions do not exist

Current Faults

If the Faults LED is illuminated, the TDR6 has detected a current fault. Current faults are reported in real time. This means that the Current Faults function displays only currently existing conditions.

The faults generated depend on the option modules installed in your TDR6.

To determine if any other faults have occurred, review the Fault History Log.

Fault History

The TDR6 maintains a log of all the faults that it detects over a period of time, not just the current faults. The TDR6 detects a variety of hardware faults as well as operational faults that are not reported as current faults and that do not illuminate the Fault LED. These faults are all logged in the fault history.

All faults are stored in volatile memory until the power is turned off or the unit is reset.

Time Tags

The TDR6 has a battery backed, internal real-time clock. This clock is used to time tag faults. A time tag enables you to determine when and how often a particular fault has occurred.

Fault History Descriptions

Fault history descriptions are in the History function of the Faults menu and are displayed as ASCII strings with the following information:

- Time tag
- Command mnemonics
- Fault descriptor

For example:

Time Tag	Command Mnemonics	Fault Descriptor
15:23:17	HD	FIFO Idle

The following table defines the command mnemonics and indicates the associated option modules.

Command Mnemonics		
Abbreviation	**Command Mnemonics**	**Option Module**
ADA	Audio Decoder Channel A	TAUD-6100 or TDEC-6100[1]
ADB	Audio Decoder Channel B	TAUD-6100 or TDEC-6100[1]
ADC	Audio Decoder Channel C	TAUD-6100
ADD	Audio Decoder Channel D	TAUD-6100
ADE	Audio Decoder Channel E	TDEC-6100[1]
ADF	Audio Decoder Channel F	TDEC-6100[1]
CA	PGCA Control	TMAC-6125
DC	Decoder Controller	TMAC-6125
INP	Input Control	TMAC-6125
MC	Master Controller	TMAC-6125

Command Mnemonics (continued)		
Abbreviation	Command Mnemonics	Option Module
DMD.A	QPSK Demodulator A	TDEM-6110
DMD.B	QPSK Demodulator B	TDEM-6110
DMD.C	QPSK Demodulator C	TDEM-6110
DMD.D	QPSK Demodulator D	TDEM-6110
UDA	User Data A	TMAC-6125
UDB	User Data B	TMAC-6125
VD	Video Decoder	TDEC-6100
HDVD	High Definition Video Decoder	TDEC-6161
[1] If the TAUD-6100 is installed, it controls ADA through ADD and the TDEC-6100 controls ADE and ADF. If the TAUD-6100 is *not* installed, the TDEC-6100 controls ADA and ADB.		

The Fault Descriptors are defined in the following table.

Fault Descriptors			
Front Panel Descriptor	Fault Log Descriptor	Explanation	Possible Cause
FIFO Idle	FIFO Idle	Input to FIFO buffer has stopped	No video, audio, user data, or teletext input
FIFO Over	FIFO Overflow	FIFO input rate exceeds output rate	Delay values too great
FIFO Undr	FIFO Underflow	FIFO output rate exceeds input rate	Interrupted input
Init	Initialize Failed	Initialization failure	Corrupted configuration files or hardware failure
Bad E_b/N_o	Bad E_b/N_o	Input signal to noise ratio below DVB specification	Insufficient transmit power, improperly oriented satellite dish, improperly polarized LNB, or excessive cable loss
Input	Input Signal Loss	No input signal detected	Missing input signal or incorrect demodulator configuration
Data Err	Data Error	Errors detected in the format of the video, audio, and so on	Bit errors introduced in the link or at the source
No PIDs	No PIDs Present	No PIDs available for the selected service	Command mnemonic not enabled at the encoder
PAT Loss	PAT Timeout	PAT information not received	Missing input signal or incorrect demodulator configuration
PMT Loss	PMT Timeout	PMT information not received	Missing input signal or incorrect demodulator configuration
Sys Reset	System Reset	A system reset exception has occurred	Software or controller board error
Trans Err	Transport Error	Transport packed error occurred	Noisy transport stream input

Viewing Current Faults

Current faults can be viewed from the front panel or from a remote device.

To view current faults using the front panel:

1. From the Faults Menu select Current.

   ▫ If no current faults exist, the LCD displays `No Faults`.

   ▫ If current faults do exist, the LCD displays all faults that are currently occurring, beginning with the highest priority fault. If more than one current fault exists, a right-pointing arrow appears on the right side of the LCD.

2. To view additional faults, press the Up button. Pressing the Up button when the last fault is displayed will take you back to the beginning of the list.

To view current faults using a remote unit issue the `FC` command.

- ▪ If no current faults exist, the remote unit displays `No Faults`.

- ▪ If current faults do exist, the remote unit displays current faults in the following format:

```
Current Faults: Requested on 12/01/2003 at 14:20:11
----------------------------------------------------
HDVD INPUT SIGNAL LOSS
```

Viewing the Fault History Log

The fault history log can be viewed from the front panel or from a remote device. To view the fault history log from the front panel:

3. From the Faults Menu select History. The Fault History Log is displayed, beginning with the most recent fault.

4. To view additional faults, press the Up button. Pressing the Up button when the last fault is displayed will take you back to the beginning of the list.

> **NOTE**
> The date on which a fault occurred is only available through the remote port.

To view the fault history log from a remote device issue the `FH LOG` command.

The remote displays the fault log history using the following format:

```
Fault Log: Requested on 12/01/2003 at 16:20:42
------------------------------------------
12/01/2003 15:23:17 HD, INPUT LOSS (CLEARED)
12/01/2003 08:57:39 ADA, DATA ERROR (CLEARED)
12/01/2003 08:57:09 ADA, NO PIDS PRESENT (CLEARED)
```

Clear Fault History Log

The fault history log can be cleared from the front panel or from a remote unit.

To clear the fault history log from the front panel:

1. From the Fault Menu select Clear. The phrase `Press ENTER to Clear` appears.

2. Press Enter. The fault history log is now clear.

To clear the fault history log from a remote unit issue the `FAULTLOGCLEAR` command.

Initialization Self-Test Function

The TDR6 has several built-in-self-tests. many of these tests are performed automatically when the unit is powered up or reset. Faults detected when the unit is powering up are displayed as error messages on the LCD screen.

Other self-tests are performed during real-time operation as the system monitors the transport stream. Faults detected while the unit is running are indicated by the LEDs on the front panel.

You can also query the system on the status of faults using the Faults menu.

Troubleshooting the QPSK Demodulator

This section provides information on troubleshooting the QPSK demodulator in a TDR6 configured with a TDEM-6110 option module.

Input Status LED Not Illuminated

If the Status LED is not illuminated, the demodulator, decoder, or the transport stream is *not* locked. This problem may be caused by:

- Receive signal E_b/N_0 level is to low
- Receive signal power level is to low
- Receive carrier offset is wrong

Receive Signal E_b/N_0 Level

The E_b/N_0 value in the Details menu under Input/Status displays the estimated E_b/N_0 level of the receive signal in units of decibels (dB).

The minimum E_b/N_0 level required by the QPSK demodulator for flawless video reception at each Viterbi Code Rate is listed in the following table.

Viterbi Code Rate And Eb/No Minimum Levels for QPSK Demodulator	
Viterbi Code Rate	**Minimum E_b/N_0 (dB)**
1/2	4.5
2/3	5.0
3/4	5.5
5/6	6.0
7/8	6.4

An E_b/N_0 level above the minimum DVB requirement is acceptable.

- If the E_b/N_0 level drops below the minimum DVB requirement, the video reception can be interrupted or of poor quality.
- If the E_b/N_0 level is above the minimum DVB requirement, the TDR6 should acquire the carrier, demodulate the signal, allow the decoder to lock the transport stream, and provide decoded video and audio output.

For information on estimating the E_b/N_0 level, refer to the appendix on the QPSK demodulator.

Receive Carrier Offset

The Offset value displays the difference, in MHz, between the *actual* receive carrier frequency and the frequency *determined by* subtracting the LO Freq parameter from the RF Freq parameter (RF Ð LO), which have been entered by the user. To achieve carrier lock, the difference between the two frequencies, as shown in the Offset, must be less than 2 MHz; however, to achieve optimum performance, the carrier Offset should be as close to zero as possible.

While the TDR6 is trying to lock onto a receive carrier, the Offset value is not valid. When the TDR6 is locked onto the receive carrier, the Offset displays the number of MHz you need to adjust the RF Freq in order to achieve optimum performance.

To achieve optimum performance, the Offset frequency should be as close to 0 as possible.

For the procedures used to query the offset parameter and to adjust the RF and LO parameters, refer to the chapter on configuration.

Demodulator Does Not Lock

If the demodulator does not lock, verify that the receive signal E_b/N_0 and power levels are above the minimum DVB limits. If the receive signal E_b/N_0 and power levels are sufficient, confirm that following settings match those of the modulator:

- RF frequency (RF Freq)
- LO frequency (LO Freq)
- Transport stream data rate (Data Rate)
- Viterbi code rate (Code Rate)

Demodulator Locks Intermittently

If the demodulator locks intermittently, but the decoder does not lock, confirm that the E_b/N_0 level is above the minimum DVB limits. If the E_b/N_0 is sufficient, confirm that the Viterbi code rate is set correctly.

Performance Problems

If performance is low, take the following actions:

- Replace the cable from the LNB to the input port on the TDR6.
- Check for ground loop potential.
- Check the carrier offset parameter. If carrier is off by more than 1.5 Mhz from the center, then change RF or LO parameters to reduce the carrier offset.

  For the procedures used to query the offset parameter and to adjust the RF and LO parameters, refer to the chapter on configuration.

- Check adjacent channel spectrum to ensure that there is no adjacent channel interference
- Ensure that the bit rate does not exceed the maximum bit rate for a given transponder bandwidth.

  Refer to the QPSK demodulator appendix for a table providing information related to bit rates versus transponder bandwidth.

Technical Specifications

A

The specifications for your TDR6 depend upon the specific option modules installed.

FACTORY-CONFIGURABLE FEATURES

INPUT INTERFACE MODULES   TDEM-6110 Module – Four switchable Input QPSK/8PSK/16QAM Receiver
- Four selectable L-band inputs
- DVB®-compliant FEC decoding, deinterleaving, and descrambling
- LNB power supplied through the L-band feed cable, 13V, 18V,or OFf selectable, 350mA maximum current

HDTV DECODING
HD VIDEO PROCESSING   TDEC-6161 Module
- MPEG-2 4:2:0 Main Profile @ High Level (up to 70 Mbps)
- ATSC resolutions
    - 1920 x 1080i (25, 30, and 29.97 fps)
    - 1280 x 720p (60 and 59.94 fps)

HD VIDEO OUTPUT   TDEC-6161 Module
- Two serial digital outputs per SMPTE 292M SDI @ 1.485 Gbps, two BNC connectors

HD AUDIO OUTPUT   TAUD-6100 Module
- Four AES/EBU digital stereo pairs (eight mono channels) via four BNC connectors
- MPEG decoding and Dolby AC3 decoding of 2- or 5.1-channels through an external decoder

SDTV DECODING
SD VIDEO PROCESSING   TDEC-6100 Module
- MPEG-2 4:2:0 Main Profile @ Main Level (1 to 15 Mbps)
- MPEG-2 4:2:2 Studio Profile @ Main Level (2.5 to 50 Mbps)
- Horizontal resolutions: 720, 704, 544, 480, and 352
- Vertical resolutions: 480/240 (NTSC) and 576/288 (PAL)

SD VIDEO OUTPUT   TDEC-6100 Module
- Composite analog NTSC (525) or PAL (625), BNC connector
- Serial digital component video (SMPTE 259M), BNC connector

SD VBI DATA   TDEC-6100 Module
- Proprietary passage of NTSC line 21 closed captions
- DVB 4:2:2 expanded windows carriers WSS, VPS, VITC, CC, AMOL, XDS, etc.

SD AUDIO OUTPUT   TDEC-6100 Module
- Two AES3 digital stereo pairs, XLR
- Two AES3 digital stereo pairs @ 48 kSps, embedded in SDI, per SMPTE 272A
- Two analog stereo pairs, terminal block connector

TAUD-6100 Module
- Four AES3 digital stereo pairs, BNC
- Dolby AC3 pass-through of 2- or 5.1-channels for an external Dolby decoder, 64 to 640 kbps @ 48 kSps
- MPEG Layer II, sampling rates of 32, 44.1, and 48 kSps, output rates from 64 to 384 kbps

STANDARD FEATURES

DATA PROCESSING	TMAC-6125 Module
	■ DVB$^{®}$ ASI transport input and output, BNC connector
	■ Two independently programmable auxiliary data ports on DB-9 connectors
	    ■ Asynchronous: 1200 to 38400 bps, EIA-232 and EIA-422 levels
	    ■ Synchronous: 1 to 2048 kbps, resolution 1 bps, EIA-422 levels

CONDITIONAL ACCESS	PGCA proprietary conditional access BISS (Basic Interoperable Scrambling System) Modes 0, 1, and E
FRONT PANEL CONTROL	Pushbuttons, illuminated LCD, bright indicator LEDs
REMOTE CONTROL	■ RS-232 on a DB-9 female connector ■ Ethernet interface on an RJ-45 female connector
PHYSICAL	■ 2U standard 19" rack-mount – 8.9 cm high, 48.3 cm wide, 58.4 cm deep (3.5" x 19" x 23") ■ Weighs less than 10.5 kg (23 lbs)
POWER SUPPLY	Autosensing, autoranging 90 to 240 VAC, 50 to 60 Hz universal power supply, 44 Watts (typical)
OPERATING CONDITIONS	Ambient temperature: 0° to 45°C

Default Configurations

B

This appendix provides the settings for the TDR6 default factory configurations. All parameter settings are the same for all factory defaults, except where noted.

The TDR6 is set to the DVB-compliant defaults at the factory.

Defaults		
Parameter	**Settings for DVB, Default1, Default2, and Default3 Configurations**	**Exceptions**
Input	ASI	Default3 = RF_A
Demodulator A - D		
RF Frequency	11210 MHz	
LO Frequency	10000 MHz	
Data Rate	8448000 bps	
Code Rate	5/6	
LNB Power	Off	
Modulation	QPSK	
Rolloff	25RCRO	
Tuner Freq	1210	
Sym Rate	5500187	
Standard-Definition Video Decoder		
Video PID	Defaults to the first video channel detected in the selected service.	
Auto Select	On	
Video Mode	PAL If the selected service is NTSC, the auto-detect function of the video decoder senses the mode and automatically switches to the NTSC mode.	
PAL Submode	I (in PAL mode only)	
Setup 7.5 IRE	Auto (in NTSC mode only)	
Video Delay	0	
Vertical Offset	0	
Horizontal Offset	0	
Tiernan Closed Captions	Off	
High-Definition Video Decoder		
Video PID	Defaults to the first video channel detected in the selected service.	
Video Format	720p	
Video Frame Rate	59.94	

Defaults (continued)		
Parameter	**Settings for DVB, Default1, Default2, and Default3 Configurations**	**Exceptions**
Video Delay	0	
Audio Decoder A - F		

Audio PID	Defaults to the first English audio channel detected in the selected service. If none of the audio channels are in English, the audio decoder selects the first audio channel detected in the selected service.
	
	Audio Decoder PID Default1, 2, 3
	     A 36 36
	     B 37 37
	     C 38 38
	     D 39 39
	     E 36 38
	     F 37 39
		For Defaults 1, 2, and 3, Audio Decoder E and F select PIDs 38 and 39.

Auto Select	On	
Source	MPEG-2	
Channel Mode	Stereo If the audio mode in the selected service is not stereo, the auto-detect function of the audio decoder senses the correct mode and automatically switches to it.	
Audio Volume	18dBu	
Preferred Language	English If none of the audio channels in the selected service are in English, the audio decoder selects the first audio channel detected in the selected service.	
Delay	0	
User Data A - B		
PID	Defaults to the first user data channel detected in the selected service.	
Auto Select	On	
Baud Rate	38400bps	
Data Bits	8	
Parity	None	
Stop Bits	1	
Interface	RS-232	
Handshake	Off	
Source Type	Asynchronous	
Remote Control		
Baud Rate	38400bps	
Data Bits	8	
Parity	None	
Stop Bits	1	
Soft Flow Control	Off	

Defaults (continued)		
Parameter	**Settings for DVB, Default1, Default2, and Default3 Configurations**	**Exceptions**
Hard Flow Control	On	
Front Panel Access		
Access	Unlocked	
Password	7384	
Ethernet		
IP Address	192.200.9.201	
IP Mask	255.255.255.0	
IP Gateway	0.0.0.0	
PGCA		
Auto Select	On	

Port Pinouts

C

Remote Port Pin Assignments			
Pin	**Signal**	**Direction**	**Signal Definition**
1	Unused	—	—
2	TXD	input	Receive Data
3	RXD	output	Transmit Data
4	Unused	—	—
5	GND	—	—
6	DTR	input	Pulled High
7	Unused	—	—
8	Unused	input	—
9	Unused	input	—
Shell	GND	—	—

Fault Relay Port Pin Specifications	
Pin	**Signal**
1	Common (grounded)
2	No Connection
3	Normally Closed
4	No Connection
5	No Connection
6	Normally Open

Ethernet Port Pin Assignments		
Pin	**Signal**	**Signal Definition**
1	TD+	Transmit Data positive
2	TD−	Transmit Data negative
3	RD+	Receive Data positive
4	NC	No connect
5	NC	No connect
6	RD−	Receive data negative
7	NC	No connect
8	NC	No connect

User Data port Pin Specifications			
Pin Number	**Standard RS232**	**Tiernan Synchronous**	**Tiernan Asynchronous**
1	Unused	—	—
2	Unused	—	—
3	TD— Transmit Data	TD+ Transmit Data	TD+ Transmit Data
4	Unused	—	—
5	GND	GND	GND
6	—	—	—
7	RTS— Ready To Send	EN- Data Valid	Unused
8	CTS— Clear To Send	TD- Transmit Data	TD- Transmit Data
9	Unused	—	—
Shell	GND	GND	GND

Port Specifications

D

TMAC-6125 Specifications

ASI In and ASI Out Port Specifications	
Signal amplitude	800mVpp minimum
Data coding	8B/10B per DVB specification
Reference clock	27 MHz, 100 ppm stability
Input return loss	>15 dB
Connection type	BNC Female
Data rate	104 Mbps maximum Stability >100 ppm

User Data Port Specifications	
Port type	DB-9 Female
Signal	RS−422 differential level
Baud rate	▪ Synchronous—4.096 Mbps ▪ Asynchronous—38400 bps
Signal	RS−232 differential level

Fault Relay Port Specifications	
Port type	RJ-11 Female
Signal	Relay Closure

Ethernet Port Specifications	
Port type	RJ-45 Female Twisted Pair
Impedance	100Ω
Signal	IEEE 802.3
BAUD rate	10Mbps

Remote Port Specifications	
Port type	DB9 Male
Signal	RS-232

TDEC-6100 Specifications

Composite Port Specifications	
Port type	BNC female
Impedance	75Ω
Signal amplitude	1Vpp

D1 Port Specifications	
Port type	BNC female
Impedance	75Ω
Signal amplitude	1Vpp

Analog Audio Output Port Specifications	
Port type	Terminal blocks
Impedance	30 Ω balanced, 600 Ω factory selectable
Max amplitude	18 dBU

AES/EBU Port Specifications	
Port type	XLR male
Impedance	100Ω balanced

TDEC-6161 Specifications

SD 1 and SD2 out Port Specifications	
Port type	female BNC
Impedance	75 Ω
Signal amplitude	800 MVpp

TAUD-6100 Specifications

Digital Audio Port Specifications	
Port type	BNC female
Impedance	75 Ω balanced

**TDEM-6110
Specifications**

LNB Port Specifications	
Port type	female F-type
Impedance	75 Ω
Frequency range	L-band, 950 to 2150 MHz
Step size	125 kHz
Power level	-65 dBm to -25 dBm
Data rate	1 Msps to 30 Msps
VSWR	1.5:1

Tiernan VBI Data Transmission

E

Overview The latest series of Tiernan encoders and decoders can be configured to transmit various types of Vertical Blanking Interval (VBI) data when it is present in the input video.

The following decoders and encoders support one or more methods for transmitting VBI data:

- TDR6 – software 3.20 or later
- TE6000A and TE6000 – software V2.21 or later

VBI Basics A standard NTSC TV signal consists of 525 horizontal lines, referred to as a frame. Each frame is divided into two fields, each with 262 ½ lines. The first 21 lines of each field are the VBI region; the remaining lines contain the active video picture.

A standard PAL TV signal consists of 625 horizontal lines, referred to as a frame. Each frame is divided into two fields, each with 312 ½ lines. The first 22 lines of each field are the VBI region; the remaining lines contain the active video picture.

For standard NTSC and PAL video encoding, the first 6 lines of the VBI region contain vertical timing pulses. VBI data is not allowed on these lines, however the remaining lines in the VBI region are available to carry any type of data.

Normal *Field* for an Encoded Picture Frame
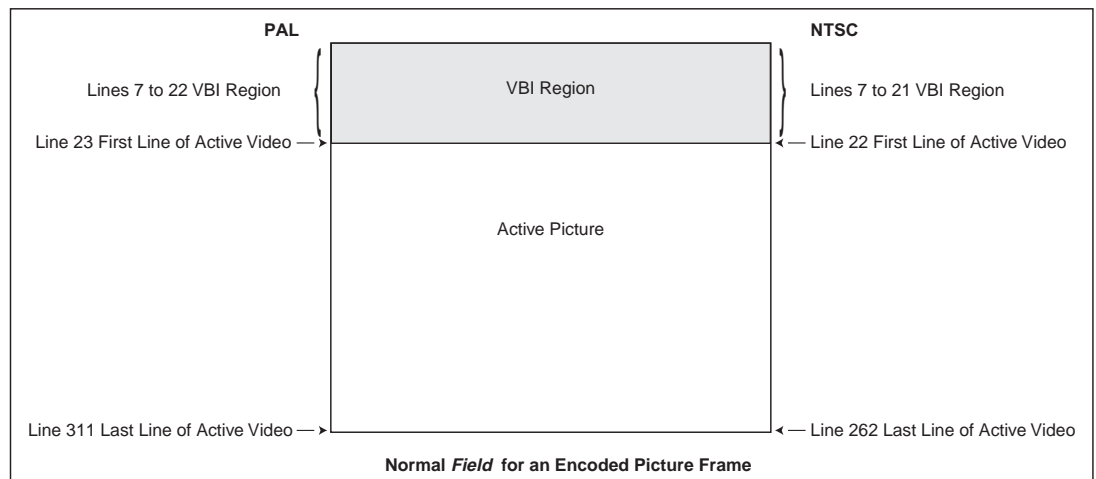
Typical forms of data included in the VBI of broadcast video transmissions are World System Teletext (WST), VPS, WSS, NABTS, Closed Captions, XDS, AMOL, Vchip, and VITC.

MPEG and VBI　　Originally, the MPEG video compression scheme discarded all VBI information and included only the compressed, active video portion of the picture for transmission. This caused all VBI data to be lost when the video was digitally compressed for transmission using MPEG.

Today, however, enhancements to the original MPEG compression system have provided two methods for including VBI data in digital-compressed MPEG streams:

- The first method is to extract the data from the baseband video input and insert that data digitally into the transport stream as either a dedicated PES stream on a dedicated PID, as in DVB-Teletext, or as an extended data field in the video frame header information as in ATSC-CC.

- The second method is to shift, or expand, the active video portion of the picture to include the VBI lines in the compressed picture frame, as in DVB 4:2:2 expanded windows.

For either of these methods to work, it is required that ***both*** the encoder and decoder are:

- Functionally capable of processing the required video

- Correctly configured, either manually or via auto-sensing functionality, for the employed VBI method

All of the VBI schemes described in this document, with the exception of Tiernan Proprietary Closed Captions, adhere to industry standards and formats, defined either by ATSC or DVB. Tiernan Radyne ComStream equipment does inter-operate with all other vendor's equipment that is found to be compliant with these industry standards.

Tiernan's TDR6 decoder can process data contained in the VBI region of a video signal according to the following methods and standards:

- Tiernan-CC – A Tiernan proprietary scheme for transmission of Line 21 closed captions included on a composite analog NTSC or component digital (525) format video signal.

- DVB 4:2:2 Expanded Windows – DVB standard for transmission of 16 or 32 lines of VBI data included on a composite analog or component digital (SDI) format video signal. This standard supports both PAL/625 and NTSC/525 format video standards.

This section describes how to configure your system for successful end-to-end processing of VBI data for each VBI scheme. For a detailed description of the front panel or remote commands used to implement the various VBI schemes, refer to the appropriate command sections found in this manual.

Tiernan Proprietary Closed Captions (Tiernan CC)

Using Tiernan proprietary closed captions, two lines of VBI information are encoded per frame (one per field) at the expense of losing two lines of active video (one per field). The encoded picture is simply shifted up one line to include the last line of VBI and to exclude the last line of active video in each field.

Tiernan CC is for NTSC Format Only

VBI Region

←— Line 21 Becomes First Line of Active Video in Tiernan CC Mode

↕ 1 line

Encoded Picture Is Shifted
UP One Line

←— Line 261 is Last Line of Active Video in Tiernan CC Mode
←— Last Line of Normally Active Video Is Lost (Line 262)

↕ 1 line

Tiernan CC Field for an Encoded Picture Frame
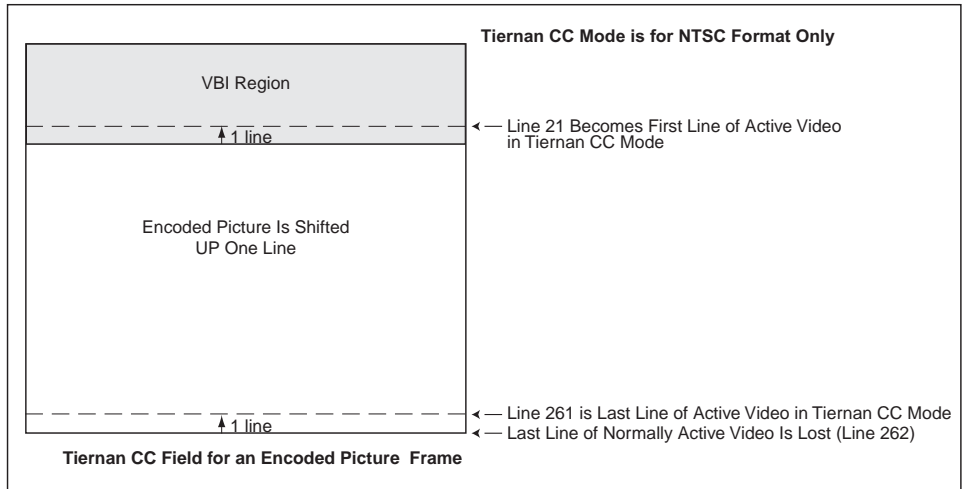
This proprietary mode is intended as a method to transmit line 21 EIA-608 closed captions in an NTSC system without incurring more bandwidth requirements.

Tiernan proprietary closed captions are supported on a composite analog NTSC or component digital (525) format video signal.

Operational Considerations

Ensure that VBI teletext is *disabled* when closed captions are enabled, as teletext overwrites all other VBI data.

Hardware Requirements

- Encoders will properly process Tiernan closed captions with any of the following modules: TVIP-6021, TVIP-6025, or TVIP-6001.
- The TDR6 decoder processes VBI data in its standard configuration.

End-to-End Configuration

To configure the encoder and decoder for Tiernan proprietary closed captioning, follow these steps:

Encoder

1. Ensure that Teletext is disabled. Issue the front panel command
   `Config>Service #>VBI>Teletext>Enable=off` or the remote
   `TT ENABLE Off` command.

2. Ensure that closed caption VBI data is included in the selected service video input signal.

3. Enable the encoder for Tiernan closed captions. Issue the front panel command `Config>Service #>VBI>Tiernan CC=On` or the remote `VE TCC ON` command.

Decoder

4. Set the decoder VBI format control to automatically detect the type of VBI data to decode. Issue the front panel command `VBI>Format>VBI Format Cntrl=Auto` or the remote `VBI CONTROL AUTO` command.

5. If your system requires you to manually set the type of VBI data to decode, follow these steps:

   a. Set the decoder VBI format control to manual. Issue the front panel command `VBI>Format>VBI Format Cntrl=Manual` or the remote `VBI CONTROL MANUAL` command.

   b. Set the VBI format to Tiernan closed captions. Issue the front panel command `VBI>Format>VBI Format=Tiernan CC` or the remote `VBI FORMAT TIERNANCC` command.

DVB 4:2:2 Expanded Windows, 16-line and 32-line

Tiernan encoders and decoders support both 16- and 32-line expanded windows operations. As with normal video encoding, the first 6 lines of the VBI region contain timing set-up information. Expanded Windows use the remaining lines in the VBI region, either 16 or 32 per frame (8 or 16 per field), to transmit data.

16-Line Expanded Windows *Field* for an Encoded Picture Frame

PAL		NTSC
Lines 7 to 22 VBI Data	VBI Region	Lines 7 to 21 VBI Data
Line 23 First Line of Active Video →		← Line 22 First Line of Active Video
	Active Picture	
Line 311 Last Line of Active Video →		← Line 262 Last Line of Active Video

32-Lines Expanded Windows *Field* for an Encoded Picture Frame
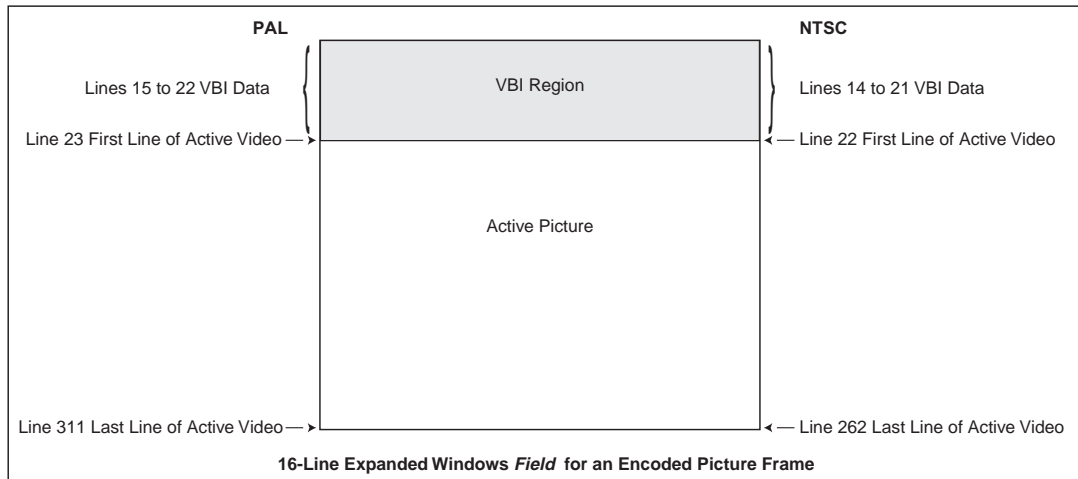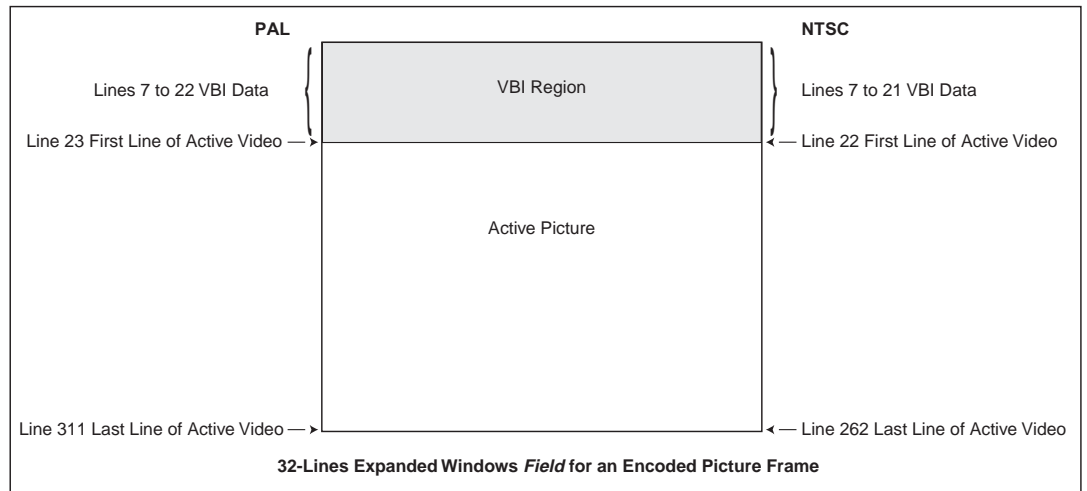
DVB 4:2:2 Expanded Windows is supported on a composite analog or component digital (SDI) format video signal. This standard supports both PAL/625 and NTSC/525 format video standards, and can transmit any of the following VBI services:

- PAL mode: Teletext, PDC, WSS, and VPS
- NTSC mode: ATSC Closed Captions, V-Chip, AMOL I and II, and VITC

Operational Considerations

- Ensure that both VBI teletext and closed captions are disable when either 16- or 32-line expanded windows are enabled, as teletext and closed captions overwrite expanded windows data.
- Chroma must be set to 4:2:2 for proper expanded windows operations.

Hardware Requirements

- Encoders will properly process Expanded Windows VBI data with any of the following modules: TVIP-6021, TVIP-6025, or TVIP-6001.
- The TDR6 decoder processes VBI data in its standard configuration.

End-to-End Configuration

To configure the encoder and decoder for DVB 4:2:2 Expanded Windows operation, follow these steps:

Encoder

1. Ensure that all other VBI schemes are disabled.
2. Ensure that VBI data is included in the selected service video input signal.
3. Set chroma to 4:2:2 mode. Issue the front panel command `Config>Service #>Video>Chroma=4:2:2` or the remote `VE.<port> CHROMA 4_2_2` command.
4. Configures the encoder to transmit either 16 or 32 lines of VBI information. Issue the front panel command `Config>Service #>VBI>Expand> VBI_Passthru=type` or the remote `VE VBI_PASS type` command, where type is set to 16_lines or 32_lines.

Decoder

5. Set the decoder VBI format control to automatically detect the type of VBI data to decode. Issue the front panel command `VBI>Format>VBI Format Cntrl=Auto` or the remote `VBI CONTROL AUTO` command.

6. If your system requires you to manually set the type of VBI data to Expanded Windows, follow these steps:

   a. Set the decoder VBI format control to manual. Issue the front panel command `VBI>Format>VBI Format Cntrl=Manual` or the remote `VBI CONTROL MANUAL` command.

   b. Set the VBI format to either 16- or 32-lines Expanded Windows.

   From the front panel, issue the command `VBI>Format>VBI Format=#` where # is set to 16-line or 32-line.

   From a remote terminal, issue the command `VBI FORMAT #` where # is set to `lines16` or `lines32`.

Encoder Command Listing

This section provides a detailed description of the front panel and remote commands used to configure Tiernan encoders for VBI operations.

Front Panel Commands for *Encoder* Configuration

Tiernan Closed Captions Front Panel Commands

Config>Service # >VBI>CC — used to configure the encoder to transmit closed captions		
Tiernan CC	configures the encoder to transmit Tiernan closed captioning information The Tiernan CC transmission described in this document is ***Tiernan proprietary***. Only Tiernan decoders accommodate the Tiernan CC feature described in this document: ***Note***: Tiernan CC should ***not*** be implemented in PAL mode, as the closed caption information will be decoded and placed on line 22 of the video.	■ on – encodes two lines of VBI information per frame (one per field) at the expense of losing two lines of active video (one per field) The encoded picture is simply shifted up one line to include the last line of VBI and to exclude the last line of active video in each field. ■ off – does not encode any VBI information (default) ***Note***: Data transmitted in the VBI region using the Tiernan CC command will experience a degradation in quality given the inherently "lossy" compression of MPEG.

Expanded Windows Front Panel Commands

Config>Service # >VBI>Expand — used to configure the encoder to transmit data in 16-line or 32-line expanded windows mode		
VBI_Passthru	Configures the encoder to transmit either 16 or 32 lines of VBI information	■ Off – disables expanded windows mode (default) ■ 16-line – enables 16-line expanded windows mode ■ 32-line – enables 16-line expanded windows mode

Remote Commands for Encoder Configuration

Tiernan Closed Captions Remote Commands

Remote Command	Parameter Range	Description
VE TCC	On, Off	Configures the encoder to transmit Tiernan closed captioning information. Parameters are: ■ On = encodes two lines of closed captioning information per frame (one per filed) at the expense of losing two lines of active video (one per field) ■ Off = does not encode any closed captioning information (default) Front panel command: Config>Service>VBI>CC>Tiernan CC

Expanded Windows Remote Commands

Remote Command	Parameter Range	Description
VE VBI_PASS	Off, 16_LINES, 32_LINES	Configures the encoder to transmit either 16 or 32 lines of VBI information ■ Off – disables expanded windows mode (default) ■ 16_lines – enables 16-line expanded windows mode ■ 32_line – enables 16-line expanded windows mode

Option Module Overview

Tiernan's powerful and highly sophisticated products integrate a proven modular design which provides flexible, highly-reliable, customized solutions to met your requirements. Each product's modular chassis supports a variety of option modules enabling the IRD to be configured for a wide-range of HDTV and SDTV services.

Tiernan option modules are easily installed in the field for system upgrades or repairs. However, before working with any option modules, please read this chapter in order to familiarize yourself with the:

- Option module components
- Procedures for installing and removing option modules from a chassis

NOTE

Tiernan periodically updates existing option modules and releases new option modules. For more information on available option modules, or to add functionality to your Tiernan products, contact Tiernan Customer Service.

Option Module Components

Tiernan option modules, shown in the following illustration, consist of the following components:

- Extractor tab used to remove the module from the chassis
- Filler plate, which must be screwed into the chassis once the module is installed to ensure adequate grounding for emission suppression
- A backplane edge connector which is seated, or plugged into, the unit's backplane

Typical Option Module

CAUTION!
Please Read
Carefully
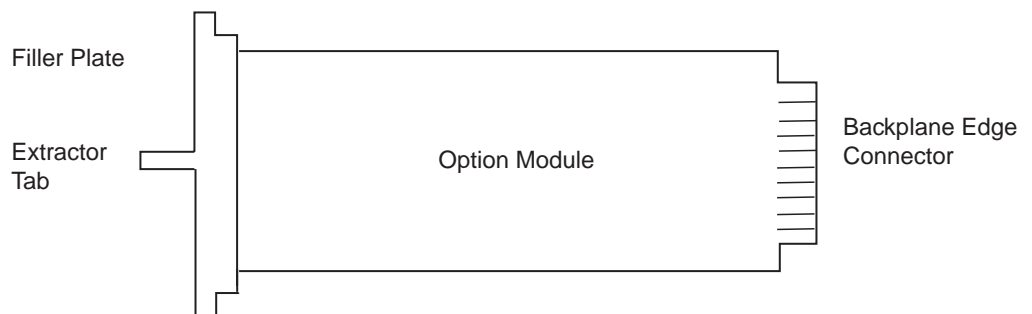
All Tiernan option modules contain static sensitive components. Use standard antistatic procedures and wear properly grounded antistatic wrist straps to prevent electrostatic damage to components when handling option modules.

Installation Procedure

To install an option module:

1. Before installing option modules, ensure that all configuration parameters specific to your site are recorded.

2. Remove power from the unit.

3. Remove the filler plate from the appropriate slot by unscrewing all end screws.

4. Align the module edges so the module slides down the center of the module guides.

5. Slowly push the module into the chassis by pushing on the area of the filler plate labelled *push here*.

6. When the module is almost completely inserted into the chassis, seat the module into the backplane by applying slightly more pressure with your fingers.

   The module is fully seated when both ends of the filler plate are flush with the chassis.

7. Screw the filler plate into the chassis.

8. Once all option modules are installed and correctly cabled, power on the unit. If the installed option module is a replacement of an existing board, the system will automatically perform a self-test and configure itself to your specific requirements.

   If the installed option module provides new functionality, the system will automatically perform a self-test and the module will configure itself to default settings.

Removal Procedure

To remove an option module:

1. Ensure that all configuration parameters specific to your site are recorded before removing any option modules.

2. Remove power from the IRD.

3. Remove any cables, connections, and attachments from the module as required.

4. Remove the filler plate by unscrewing all end screws.

5. Unseat the module from the backplane by grasping the extractor tab and pulling slowly, with even pressure.

6. Using the extractor tab, slowly withdraw the module from the chassis.

7. Place the module in a static protection bag.

8. Install the blank filler plate and replace the end screws.

9. Reattach any cables, connections, and attachments as required.

10. Power on the unit. The system will automatically perform a self-test and configure itself to your specific requirements.

Demodulator
Application Notes

G

This appendix contains additional technical information for the TDEM-6110 Demodulator option module, including information on:

- Configuration
- Rates and channel spacing
- Estimating E_b/N_0
- Troubleshooting

Configuration   This section provides technical information to supplement the basic configuration procedures provided in the chapter on configuring the TDR6.

Industry Standard LNB Frequencies

The tuner input frequency for the demodulator is divided into two components (RF and LO) to correlate with industry standards. The following table lists the RF range for common LNB LO frequencies.

RF Ranges for LO Frequencies			
RF Range (Mhz)	LNB LO (Mhz)	Input L-band Range (Mhz)	Type
3450 - 4200	5150	950 - 2150	C band
10950 - 11700	10000	950 - 2150	—
11700 - 12450	10750	950 - 2150	Domestic Ku Band
12250 - 13000	11300	950 - 2150	—

Demodulator Tuner SAW Filter

The demodulator tuner has a SAW filter (bandpass) for rejecting out-of-band noise. It is important that you correctly specify the input L-Band frequency to insure that the input spectrum is within the passband of the filter.

Check the Offset parameter to confirm that the acquired carrier is within 2 Mhz of the location you specified when entering the RF and LO parameters.

For the procedures used to query to offset parameter and to correct the offset by adjusting the RF and LO parameters, refer to the chapter on configuration.

Data Inversion / Spectral Inversion

In QPSK modulations, every symbol consists of two bits of data. These two bits are commonly referred two as the I and Q samples. Data inversion occurs when both I and Q are inverted. Spectral inversion occurs when either I or Q are inverted. Spectral inversion is caused by selecting the lower sideband instead of the upper sideband in the mixing and RF filtering process.

All Tiernan demodulators automatically check for and compensate for data/spectral inversion.

Information Rate/ Symbol Rate/Channel Spacing

This section provides rate definitions and relationships as well as information on channel spacing.

Definitions

Information Rate (Bits/Sec)

Information rate is the rate of data leaving the demodulator measured in bits per second. For Tiernan systems, the information rate is generally equal to the aggregate transport stream rate.

For the TDR6, the information rate is the data rate parameter.

Channel Rate (Bits/Sec)

Channel rate is the rate of data in the demodulator, before the FEC decoding. The channel rate equals the information rate plus the FEC encoding overhead measured in bits per second.

Symbol Rate (Symbols/Sec)

Symbol rate is the rate of symbols being transmitted through the channel measured in bits per second. For QPSK modulation, there are 2 bits per symbol.

You can query the TDR6 symbol rate using the `DMD.x SR` command. There is no front panel equivalent for the SR command.

Aggregate Rate (Bits/Sec)

Aggregate data rate is the rate of the encoder output transport stream measured in bits per second. The transport stream can be either a single transport stream or several multiplexed transport streams. The aggregate rate is generally the information rate going into the modulator or coming out of the demodulator.

Relationships

Information Rate = Aggregate Rate

$$\text{Symbol Rate} = 1/2 * (204/188) * (1/\text{Code Rate}) * \text{Information Rate}$$

where the code_rate can be 1/2, 2/3, 3/4, 5/6, 7/8.

The minimum required E_b/N_0 level varies depending on the code rate. For a table showing the relationship between the E_b/N_0 level and the code rate, refer to the chapter on troubleshooting.

Maximum Rates

Symbol Rates

The minimum and maximum symbol rates are:

- Minimum = 1 Mbaud
- Maximum = 30 Mbaud

Information Rates

The minimum and maximum information rates are provided in the following table.

Minimum and Maximum Information Rates					
Code Rate	1/2	2/3	3/4	5/6	7/8
Minimum Information Rate (Mbps)	0.92	1.23	1.38	1.54	1.61
Maximum Information Rate (Mbps)	27.6	36.8	41.5	46.1	48.4

Output Spectrum Width

To prevent intersymbol interference, the outgoing symbols are filtered by a DVB-compliant transmit filter. The filter type is a square-root raised cosine filter with roll-off factor alpha = 0.35. The result is that the output spectrum has a width of (1.35 * Symbol Rate).

The following table provides examples of information bit rates versus transponder bandwidth at each code rate.

Transponder BW (MHz)	QPSK 1/2 Mbps	QPSK 2/3 Mbps	QPSK 3/4 Mbps	QPSK 5/6 Mbps	QPSK 7/8 Mbps
54	36.8627	49.1503	55.2941	61.4379	64.5098
46	31.4016	41.8668	47.1024	52.3360	54.9528
41	27.9884	37.3178	41.9826	46.6473	48.9797
36	24.5752	32.7669	36.8627	40.9586	43.0065
33	22.5272	30.0363	33.7908	37.5454	39.4227
30	20.4793	27.3057	30.7190	34.1322	35.8388
27	18.4314	24.5752	27.6471	30.7190	32.2549
18	12.2876	16.3834	18.4314	20.4793	21.5033

Estimating E_b/N_0

The TRD6 provides an estimate of the E_b/N_0. To access this estimate:

- Using the front panel, select Details>Input>Status>E_b/N_0
- Using a remote unit, issue the command DMD.x EBNO

E_b/N_0 Definition

The E_b/N_0 expression is defined as follows:

- E_b = Energy per information bit.
- N_0 = Noise energy per Hz.

The formula for E_b/N_0, in dB is:

$$E_b/N_0 = C(dBm) - N_0(dBm/Hz) - 10\log(IR)$$

where:

- C = Carrier Power
- IR = Information Rate

E_b/N_0 Estimation Algorithm

Within the FEC decoder IC, the Viterbi decoder output is re-encoded and compared to a delayed version of the original encoder input. Incoming bit errors that are corrected will result in a difference between original input and the encoded output. These differences are accumulated for a fixed amount of time. This accumulation register can be read by the TDR6 microprocessor and gives an approximation of the signal to noise level of the input signal. Once these reading have been calibrated using an input with a known E_b/N_0, they are used by the TDR6 to accurately estimate the E_b/N_0 of the incoming signal.

Note that the estimated E_b/N_0 reading is accurate only for relatively low E_b/N_0 readings (less than 10). This is because there are not enough bit errors at higher E_b/N_0 to generate an accurate estimation.

Estimating E_b/N_0 Using a Spectrum Analyzer

Sometimes it is desirable to be able to estimate the E_b/N_0 of an input signal using a spectrum analyzer. The following equation will provide a reasonable approximation.

$$E_b / N_0 = 10 \log_{10} [(10^{D/10} - 1)(SR/IR)]$$

where:

- D = Distance in dB from top of spectrum to noise floor
- SR = Symbol Rate (symbols/sec)
- IR = Information Rate (bits/sec)

To determine the symbol rate issue the command `DMD.x SR`.

The symbol rate is not available from the front panel.

The information rate is the TDR6 data rate parameter. To determine the data rate:

- Using the front panel, select Details>Input>Demod>RF_*x*>Data Rate where *x* = A, B, C, or D
- Using a remote unit, issue the command `DMD.x DR`

Demodulator Low E_b/N_0 Alarm

The TDR6 issues a "low E_b/N_0" fault if the E_b/N_0 is ever 1 dB lower than the DVB specification. You should operate with at least a 2 dB margin to allow for rain-fade and other conditions.

Troubleshooting

This section provides information that may be helpful in troubleshooting including:

- Using a spectrum analyzer to check the configuration
- Troubleshooting commands

Spectrum Analyzer

Following are ways you can use a spectrum analyzer to check the configuration of the QPSK demodulator:

- Confirm that an input signal is present
- Confirm that spectrum is flat
- Confirm that width conforms to (1.35 ∗ symbol rate)

- Measure C/N to estimate E_b/N_0

  where

  - ❑ C is carrier power
  - ❑ N is noise floor
- Calculate the estimated E_b/N_0

  Refer to the equation for estimating E_b/N_0 using a spectrum analyzer in a previous section of this appendix.
- Transmit pure carrier to precisely locate the center frequency

NOTE If the demodulator is supplying the DC to the LNB, then the spectrum analyzer must monitor the L-band input using a T-junction. Insure that the spectrum analyzer input is protected using a DC-block. Since the spectrum analyzer has an input impedance of 50 ohms, this method will also double-terminate the input signal (i.e. lower it by 3 dB).

The demodulator will acquire only if the input carrier frequency is equal to [(RF – LO) ±2 MHz]. Once acquired, it is recommended that you optimize the RF parameter using the carrier offset status parameter. For the optimization procedure, refer to the chapter on configuring the TDR6.

Diagnostic Commands

This section describes commands you can use for troubleshooting the demodulator.

- G4 – Use this command to display the demodulator IC registers.

  Syntax – DMD.*x* G4 where *x* designates the demodulator that is the object of the command.
- Register Values – The register values are all in hexadecimal. The two registers that are most useful for debug are Register 6 and Register 31.
- Register 6 (Power Level) – This register should be almost equal to A0. This indicates that the AGC loop is locked and the signal level is optimum at the analog-to-digital converter inputs.
- Register 31 (Status) – Only the three least significant bits are active.

  - ❑ Status[0] = 1 if the symbol clock is locked
  - ❑ Status[1] = 1 if the carrier phase is locked
  - ❑ Status[2] = 1 if the carrier frequency is locked

  Note that the state of these three bits are reflected in the status LED's.
- G3 – Use this command to display the three decoder error count registers.

  Syntax – DMD.*x* G3 where *x* designates the demodulator that is the object of the command.
- Register Values – The register values are all in hexadecimal.
- Reed-Solomon Corrected – This register displays the total number of byte errors corrected by the Reed-Solomon decoder. It is reset to zero upon reaching max count.

  Any substantial channel noise will cause this register to be greater than zero.
- Reed-Solomon Uncorrected – This register displays the total number of byte errors that were detected, but not corrected, by the Reed-Solomon decoder. It is reset to zero upon reaching max count. For normal operation this register must be zero.

  Any non-corrected byte errors will result in some form of degradation in the decoder.

- Viterbi Bit Error – This register displays the number of channel bit errors during the last measurement period. This register is used to estimate E_b/N_0. If this register is zero, the E_b/N_0 is 16.00 (no noise).

  Any channel noise will cause this register to be greater than zero.

- OFFSET – Use this command to confirm the location of the carrier. The definition of this query is:

  (OFFSET = Actual RF – Programmed RF)

  The units are in Hz.

  Syntax – DMD.*x* OFFSET where *x* designates the demodulator that is the object of the command.

Table Top and Rack Mount Installation Instructions

H

This appendix presents step-by step instructions for the installation of Tiernan 1U, 2U, and 4U products. Instructions are presented for installing products:

- On a table top
- Using front rack mount brackets
- Using rear rack mount brackets

Table Top Instructions

To install a Tiernan unit on a tabletop or other flat surface, install the rubber feet included in the shipping kit, or place the unit on a rubber mat or other material that will prevent the unit from sliding and protect the table top surface.

Ensure that the unit is placed on a stable surface of sufficient size and strength where it will not be jarred or pushed off its surface. Ensure that all cables and cords are out of the way and that they will not be tripped over, as this may cause personal injury or serious damage to the unit.

To install the rubber feet, perform these steps:

1. Ensure that there are four rubber feet included in the shipping kit.
2. Break the feet apart from one another. Working with one rubber foot at a time:
   a. Remove the protective backing
   b. Place the foot under one corner of the unit, with the sticky side against the unit.
   c. Press the foot firmly against the unit. When you are finished, there should be one rubber foot under each corner of the unit.
3. Ensure that the unit's location and position provide the minimum required air flow clearance.

Front Rack Mount Instructions

To install a Tiernan unit in a standard 19-inch equipment rack using front mounting brackets, perform these steps:

1. Ensure that there are two brackets and 4 screws in the front bracket kit.

   One side of each bracket has small holes while the other side has large holes. The small holes are counter-sunk on one side. The side which is ***not*** counter-sunk is placed against the unit.
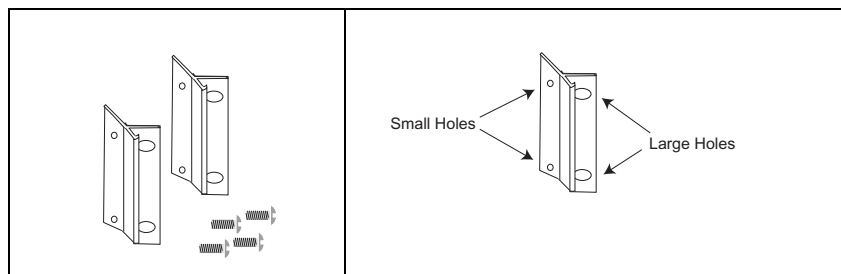
Note: The 4U unit contains 8 screws in the shipping kit. One side of each bracket has four small holes while the other side has two large holes.

2. Attach the brackets to both sides of the unit:
   a. Line up the small holes on the bracket with the unit's mounting holes, which are located towards the front of each side panel.
   b. Thread all of the screws through the bracket's small holes and into the Tiernan unit. The screws should be flush with the bracket when tightened.
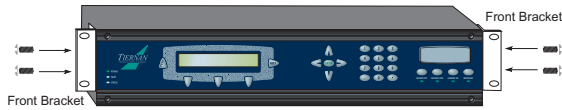
3. Mount the unit in the rack by attaching the front brackets to the rack using your own washers and bolts.

4. Ensure that the installation provides the minimum required air flow clearances at the sides and rear of the unit.

NOTE

The TDR6 is not designed to be installed with rack-mount slides.

Rear Rack Mount Instructions

The rear rack mount kit contains the following items:

- Two mounting plates
- Two rack mount brackets
- Four mounting plate screws
- Four connector screws with attached washers. *Note*: the 1U ship kit contains eight connector screws.
- Four rack mount bracket screws with attached washers
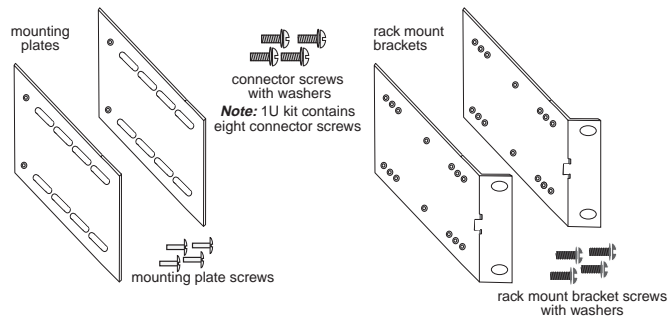
Rear Rack Bracket Mounting Instructions

To install a Tiernan unit in a standard 19-inch equipment rack using rear mounting brackets, perform the following steps:

1. Attach the mounting plates to both sides of the unit:

   a. The mounting plates have a series of oblong slots and two small holes which are counter-sunk on one side. The side which in *not* countersunk is placed against the unit.

   b. Line up the small holes on the mounting plate with the mounting holes located on the unit towards the rear of each side panel.

   c. Thread a mounting screw through the bracket and into the Tiernan unit. The screw should be flush with the plate when tightened.
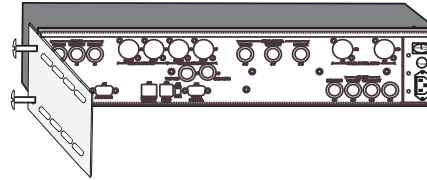
2. Align the rack mount bracket with the mounting plate. The rack mount bracket should lie flat against the outside of the mounting plate with the bracket nuts facing away from the mounting plate. The top and bottom of the bracket and plate should be even and the bracket holes should line up with the mounting plate slots.
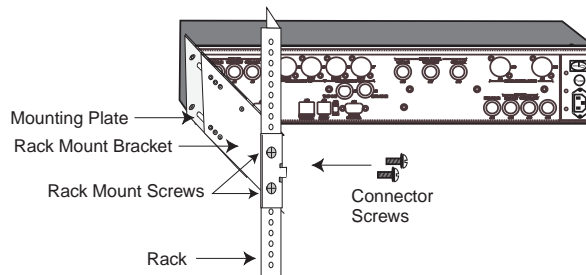
3. Attach the rack mount brackets to the rack using the rack mount bracket screws.

4. Attach the mounting plate to the rack mount bracket using *all* provided connector screws. 2U and 4U units use two connector screws per bracket, 1U units use four connector screws per bracket. Screws are inserted from the inside of the bracket.
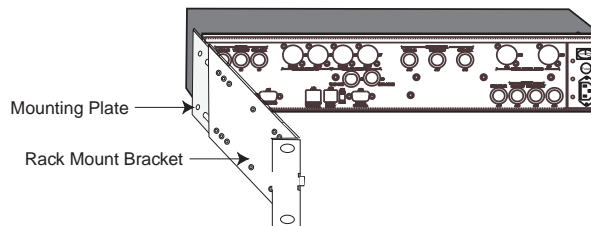
5. Ensure that the installation provides the minimum required air flow clearances at the sides and rear of the unit.

Safety Precautions   If rack-mounted units are installed in a closed or multi-unit rack, consider the following items; further evaluation by a Certifying Agency may be required.

Ambient Temperature   The ambient temperature within the rack may be greater than the room's ambient temperature. When installing the unit, ensure that the required air flow for safe operation is provided.

Rack Stability   During installation, consider weight distribution on the rack; hazardous stability conditions may arise if units are loaded into the rack unevenly.

Input Supply   Overloading of supply circuits could impact over-current protection and supply wiring. To ensure that supply circuits are not overloaded review the nameplate ratings.

Grounding   Reliable grounding of this equipment must be maintained. Pay particular attention to supply connections when connecting to power strips, rather than direct connections to the branch circuit.

Index